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DOCUMENTATION

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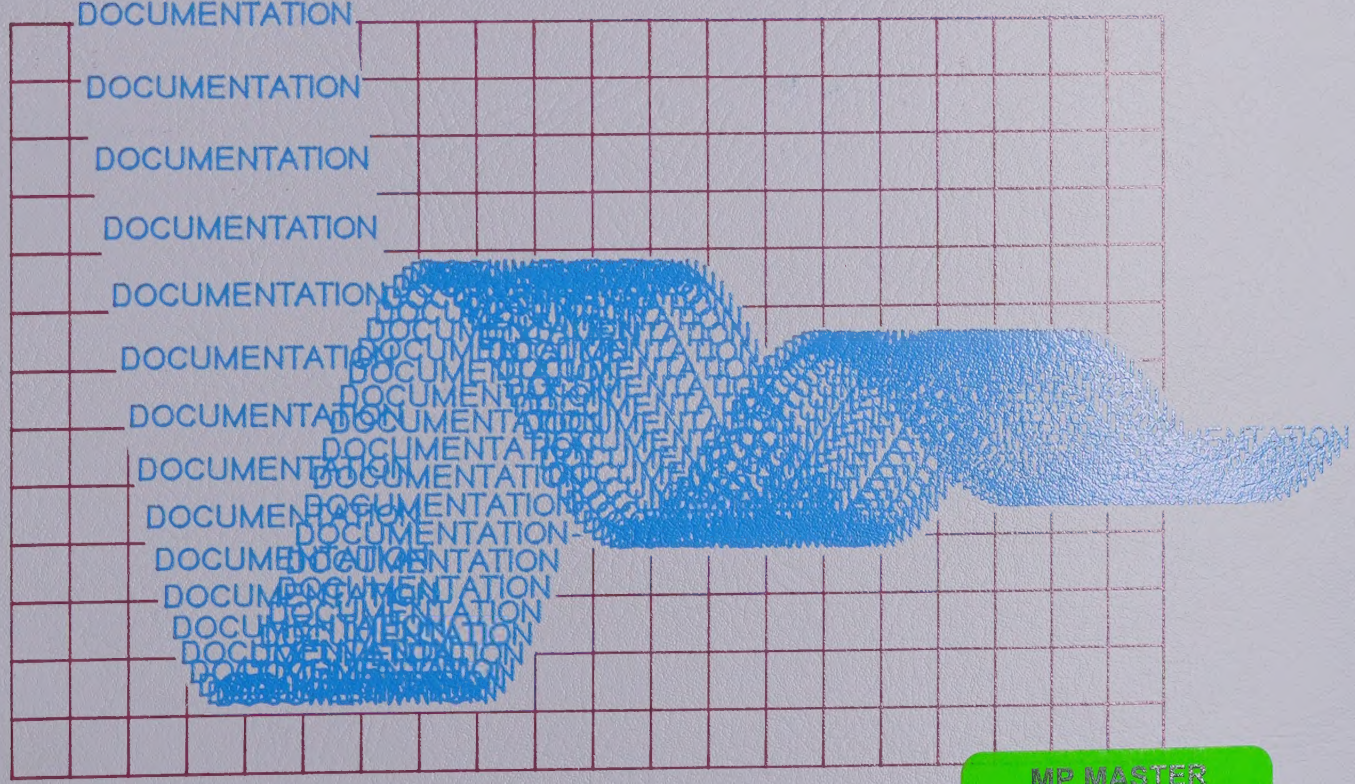

MP MASTER
MA20645

ROHDE&SCHWARZ

Test and Measurement
Division

Service Manual Instrument

SIGNAL ANALYZER

R&S FSQ3
1155.5001.03

R&S FSQ8
1155.5001.08

R&S FSQ26
1155.5001.26

Printed in the Federal
Republic of Germany

Dear Customer,

throughout this operating manual, the abbreviation FSQ is used for your Signal Analyzer R&S FSQ.

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Service and Repair

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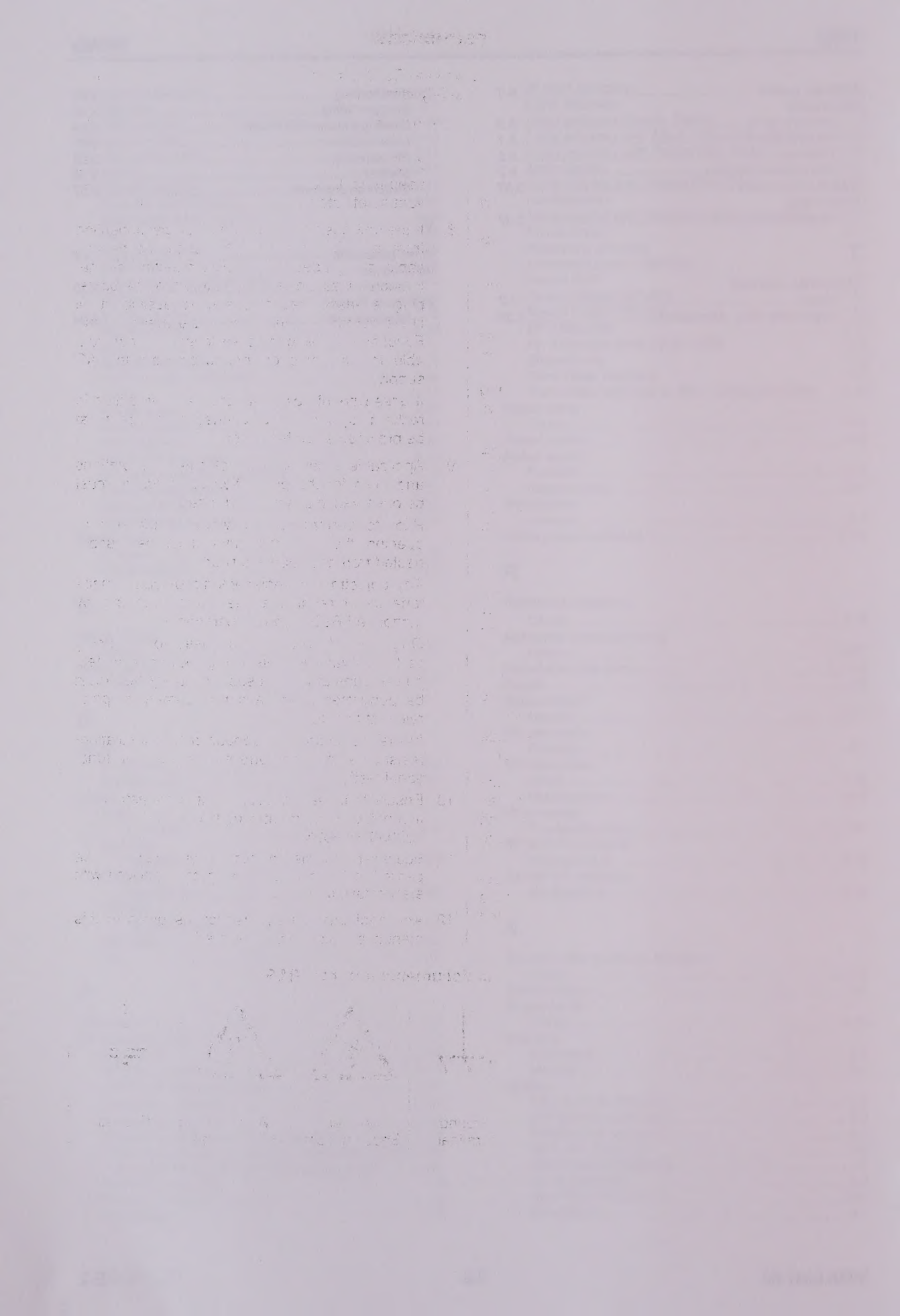


Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   Pollution severity 2, overvoltage category 2, IP degree of protection 2X, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made (installation and cabling of the unit to be performed only by qualified technical personnel).

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

10. Ensure that the connections with information technology equipment comply with IEC950/EN60950.

11. Equipment returned or sent in for repair must be packed in the original packing or in packing with electrostatic protection.

12. Any additional safety instructions given in this manual are also to be observed.

Safety-related symbols used on equipment and documentation from R&S:

Observe operating instructions

Weight indication for units >18 kg

PE terminal

Ground terminal

Danger! Shock hazard

Warning! Hot surfaces

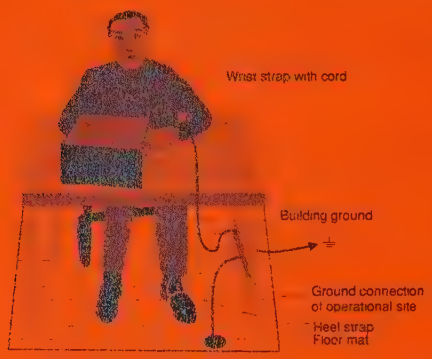
Ground

Safety Instructions

The instrument contains components which are hazardous to electrostatic exposure and which are marked by the following symbol:

ACHTUNG: EGB!
Elektrostatisch gefährdete Bauelemente erfordern eine besondere Handhabung
ATTENTION ESD!
Electrostatic sensitive devices require a special handling

- To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).

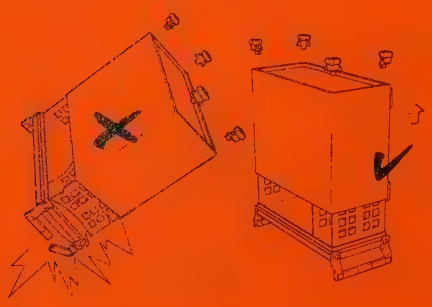


The following two methods of ESD protection may be used together or separately:

- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

The batteries used in the instrument are high-power lithium cells with a life utility of approx. 5 years. If you do not handle them properly, there is a danger of explosion. Therefore, observe the following safety instructions:

- Avoid short-circuit and loading of the battery
- Do not expose lithium batteries to high temperature or fire.
- Do not open used batteries
- Keep batteries away from children.
- Replace battery only by R&S type battery (R&S ordering number 0565.1687.00)
- Make sure to connect the battery to the appropriate terminals when replacing
- Lithium batteries are suitable for environmentally-friendly disposal or specialized recycling. Dispose them into appropriate containers, only.



- *Put the instrument on the front handles before loosing the rear feet and the tube to avoid damage of the instrument.*
- *When mounting the tube take care not to damage or pull off cables.*

Spare Parts Express Service

Phone: +49 89 4129 - 12465

Fax: +49 89 41 29 - 13306

E-mail:werner.breidling@rsd.rohde-schwarz.com

In case of urgent spare parts requirements for this Rohde & Schwarz unit, please contact our spare parts express service.

Outside business hours, please leave us a message or send a fax or e-mail. We shall contact you promptly.

Adressen/Addresses

FIRMENSITZ/HEADQUARTERS

	Phone Fax E-mail
Rohde & Schwarz GmbH & Co. KG Mühldorfstraße 15 · D-81671 München Postfach 80 14 69 · D-81614 München	+49 (89) 41 29-0 +49 89 4129-121 64 info@rohde-schwarz.com

WERKE/PLANTS

Rohde & Schwarz Messgerätebau GmbH Riedbachstraße 58 · D-87700 Memmingen Postfach 1652 · D-87686 Memmingen	+49 (8331) 108-0 +49 (8331) 108-11 24 info.rsmb@rohde-schwarz.com
Rohde & Schwarz GmbH & Co. KG Werk Teisnach Kaikenrieder Straße 27 · D-94244 Teisnach Postfach 1149 · D-94240 Teisnach	+49 (9923) 857-0 +49 (9923) 857-11 74 info.rsts@rohde-schwarz.com
Rohde & Schwarz GmbH & Co. KG Dienstleistungszentrum Köln Graf-Zeppelin-Straße 18 · D-51147 Köln Postfach 98 02 60 · D-51130 Köln	+49 (2203) 49-0 +49 (2203) 49 51-308 info.rsdc@rohde-schwarz.com service.rsdc@rohde-schwarz.com

TOCHTERUNTERNEHMEN/SUBSIDIARIES

Rohde & Schwarz Vertriebs-GmbH Mühldorfstraße 15 · D-81671 München Postfach 80 14 69 · D-81614 München	+49 (89) 41 29-137 74 +49 (89) 41 29-137 77
Rohde & Schwarz International GmbH Mühldorfstraße 15 · D-81671 München Postfach 80 14 60 · D-81614 München	+49 (89) 41 29-129 84 +49 (89) 41 29-120 50 info.rsi@rohde-schwarz.com
Rohde & Schwarz Engineering and Sales GmbH Mühldorfstraße 15 · D-81671 München Postfach 80 14 29 · D-81614 München	+49 (89) 41 29-137 11 +49 (89) 41 29-137 23 info.rse@rohde-schwarz.com
Rohde & Schwarz BICK Mobilfunk GmbH Fritz-Hahne-Str. 7 · D-31848 Bad Münder Postfach 2062 · D-31844 Bad Münder	+49 (5042) 998-0 +49 (5042) 998-105 info.bick@rohde-schwarz.com
Rohde & Schwarz FTK GmbH Wendenschlossstraße 168, Haus 28 D-12557 Berlin	+49 (30) 658 91-122 +49 (30) 655 50-221 info.ftk@rohde-schwarz.com
Rohde & Schwarz SIT GmbH Agastraße 3 D-12489 Berlin	+49 (30) 658 84-0 +49 (30) 658 84-183 info.sit@rohde-schwarz.com

ADRESSEN WELTWEIT/ADDRESSES WORLDWIDE

Albania siehe/see Austria

Algeria
Rohde & Schwarz
Bureau d'Alger
5B Place de Laperrine
16035 Hydra-Alger
+213 (21) 48 20 18
+213 (21) 69 46 08

Argentina
Precision Electronica S.R.L.
Av. Pde Julio A. Roca 710 - 6° Piso
(C1067ABP) Buenos Aires
+541 (14) 331 41 99
+541 (14) 334 51 11
alberto_lombardi@prec-elec.com.ar

Australia
Rohde & Schwarz (Australia) Pty. Ltd.
Sales Support
Unit 6
2-8 South Street
Rydalmere, N.S.W. 2116
+61 (2) 88 45 41 00
+61 (2) 96 38 39 88
lyndell.james@rsaus.rohde-schwarz.com

Austria
Rohde & Schwarz-Österreich Ges.m.b.H.
Am Europlatz 3
Gebäude B
1120 Wien
+43 (1) 602 61 41-0
+43 (1) 602 61 41-14
rs-austria@rsoe.rohde-schwarz.com

Azerbaijan
Rohde & Schwarz Azerbaijan
Liaison Office Baku
ISR Plaza
340 Nizami Str.
370000 Baku
+994 (12) 93 31 38
+994 (12) 93 03 14
rs-azerbaijan@rus.rohde-schwarz.com

Baltic Countries siehe/see Denmark

Bangladesh
BIL Consortium Ltd.
Corporate Office
House-33, Road-4, Block-F
Banani
Dhaka-1213
+880 (2) 881 06 53
+880 (2) 882 82 91

Belgium
Rohde & Schwarz Belgium N.V.
Excelsiorlaan 31 Bus 1
1930 Zaventem
+32 (2) 721 50 02
+32 (2) 725 09 36
info@rsb.rohde-schwarz.com

Bosnia-Herzegovina siehe/see Slovenia

Brazil
Rohde & Schwarz Do Brasil Ltda.
Av. Alfredo Egidio de Souza Aranha n° 177,
1° andar - Santo Amaro
04726-170 Sao Paulo - SP
+55 (11) 56 44 86 11 (general)
+55 (11) 56 44 86 25 (sales)
+55 (11) 56 44 86 36
sales-brazil@rsdb.rohde-schwarz.com

Brunei
GKL Equipment Pte Ltd.
#11-01 BP Tower
396 Alexandra Road
Singapore 119954
+65 (6) 276 06 26
+65 (6) 276 06 29
gkleqpt@singnet.com.sg

Bulgaria
Rohde & Schwarz
Representation Office Bulgaria
39, Fridtjof Nansen Blvd.
1000 Sofia
+359 (2) 96 343 34
+359 (2) 96 321 97
rs-bulgaria@rsbg.rohde-schwarz

Canada
Rohde & Schwarz Canada Inc.
555 March Rd.
Kanata, Ontario K2K 2M5
+1 (613) 592 80 00
+1 (613) 592 80 09
cgirwarnauth@rscanada.ca

Tektronix Canada Inc.
Test and Measurement
4929 Place Olivia
Saint-Laurent, Pq
Montreal H4R 2V6
+1 (514) 331 43 34
+1 (514) 331 59 91

Chile
Dymeq Ltda.
Av. Larrain 6666
Santiago
+56 (2) 339 20 00
+56 (2) 339 20 10
dymeq@dymeq.com

China
Rohde & Schwarz China Ltd.
Representative Office Beijing
Room 602, Parkview Center
2 Jiangtai Road
Chao Yang District
Beijing 100016
+86 (10) 64 31 28 28
+86 (10) 64 37 98 88
info.rschina@rsbp.rohde-schwarz.com

Rohde & Schwarz China Ltd.
Representative Office Shanghai
Central Plaza
227 Huangpi North Road
RM 807/809
Shanghai 200003
+86 (21) 63 75 00 18
+86 (21) 63 75 91 70

Rohde & Schwarz China Ltd.
Representative Office Guangzhou
Room 2903, Metro Plaza
183 Tianhe North Road
Guangzhou 510075
+86 (20) 87 55 47 58
+86 (20) 87 55 47 59

Rohde & Schwarz China Ltd.
Representative Office Chengdu
Unit G, 28/F, First City Plaza
308 Shuncheng Avenue
Chengdu 610017
+86 (28) 86 52 76 05 to 09
+86 (28) 86 52 76 10
rsbpc@mail.sc.cninfo.net

Rohde & Schwarz China Ltd.
Representative Office Xi'an
Room 10125, Jianguo Hotel Xi'an
No. 2, Huzhu Road
Xi'an 710048
+86 (29) 321 82 33
+86 (29) 329 60 15
sherry.yu@rsbp.rohde-schwarz.com

Adressen/Addresses

China
Rohde & Schwarz China Ltd.
Representative Office Shenzhen
No. 2002 Jiabin Road
Luohu District
Shenzhen 518001
+86 (755) 25 18 50 18
+86 (755) 25 18 50 18
jessica.lia@rsbp.rohde-schwarz.com

Croatia
siehe/see Slovenia

Cyprus
Hinis Telecast Ltd.
Agiou Thoma 18
Kiti
Larnaca 7550
+357 (24) 42 51 78
+357 (24) 42 46 21
hinis@logos.cy.net

Czech Republic
Rohde & Schwarz Praha s.r.o.
Hadovka Office Park
Evropská 33c
16000 Praha 6
+420 (2) 24 31 12 32
+420 (2) 24 31 70 43
office@rscz.rohde-schwarz.com

Denmark
Rohde & Schwarz Danmark A/S
Ejby Industrivej 40
2600 Glostrup
+45 (43) 43 66 99
+45 (43) 43 77 44

Ecuador
Representaciones Manfred Weinzierl
Vía Láctea No. 4 y Via Sta. Inés
P.O.Box 17-22-20309
1722 Cumbayá-Quito
+593 (22) 89 65 97
+593 (22) 89 65 97
mweinzierl@plus.net.ec

Egypt
U.A.S. Universal Advanced Systems
31 Manshiet El-Bakry Street
Heliopolis
11341 Cairo
+20 (2) 455 67 44
+20 (2) 256 17 40
an_uas@link.net

El Salvador
siehe/see Mexico

Estonia
Rohde & Schwarz Danmark A/S
Estonian Branch Office
Narva mnt. 13
10151 Tallinn
+372 (6) 14 31 23
+372 (6) 14 31 21
margo.fingling@rsdk.rohde-schwarz.com

Finland
Orbis Oy
P.O.Box 15
00421 Helsinki 42
+358 (9) 47 88 30
+358 (9) 53 16 04
info@orbis.fi

France
Rohde & Schwarz France
Immeuble "Le Newton"
9-11, rue Jeanne Braconnier
92366 Meudon La Forêt Cédex
+33 (1) 41 36 10 00
+33 (1) 41 36 11 73
contact@rsf.rohde-schwarz.com

Niederlassung/Subsidiary Rennes
37 Rue du Bignon
Bât. A
F-35510 Cesson Sevigne
+33 (0) 299 51 97 00
+33 (0) 299 51 98 77

Niederlassung/Subsidiary Toulouse
Technoparc 3
B.P. 501
F-31674 Labège Cédex
+33 (0) 561 39 10 69
+33 (0) 561 39 99 10

Office Aix-en-Provence
+33 (0) 494 07 39 94
+33 (0) 494 07 55 11

Office Lyon
+33 (0) 478 29 88 10
+33 (0) 478 79 18 57

Office Nancy
+33 (0) 383 54 51 29
+33 (0) 383 54 82 09

Germany
Zweigniederlassungen der Rohde & Schwarz Vertriebs-GmbH/Branch offices of Rohde & Schwarz Vertriebs-GmbH

Zweigniederlassung Nord, Geschäftsstelle Berlin
Ernst-Reuter-Platz 10 · D-10587 Berlin
Postfach 100620 · D-10566 Berlin
+49 (30) 34 79 48-0
+49 (30) 34 79 48 48
info.rsv@rohde-schwarz.com

Germany
Zweigniederlassung Büro Bonn
Josef-Wirmer-Straße 1-3 · D-53123 Bonn
Postfach 140264 · D-53057 Bonn
+49 (228) 918 90-0
+49 (228) 25 50 87
info.rsv@rohde-schwarz.com

Zweigniederlassung Nord, Geschäftsstelle Hamburg
Steilshooper Alle 47 · D-22309 Hamburg
Postfach 60 22 40 · D-22232 Hamburg
+49 (40) 63 29 00-0
+49 (40) 630 78 70
info.rsv@rohde-schwarz.com

Zweigniederlassung Mitte, Geschäftsstelle Köln
Niederkasseler Straße 33 · D-51147 Köln
Postfach 900 149 · D-51111 Köln
+49 (2203) 807-0
+49 (2203) 807-650
info.rsv@rohde-schwarz.com

Zweigniederlassung Süd, Geschäftsstelle München
Mühldorfstraße 15 · D-81671 München
Postfach 80 14 69 · D-81614 München
+49 (89) 41 86 95-0
+49 (89) 40 47 64
info.rsv@rohde-schwarz.com

Zweigniederlassung Süd, Geschäftsstelle Nürnberg
Donaustraße 36
D-90451 Nürnberg
+49 (911) 642 03-0
+49 (911) 642 03-33
info.rsv@rohde-schwarz.com

Zweigniederlassung Mitte, Geschäftsstelle Neu-Isenburg
Siemensstraße 20
D-63263 Neu-Isenburg
+49 (6102) 20 07-0
+49 (6102) 20 07 12
info.rsv@rohde-schwarz.com

Ghana
Kop Engineering Ltd.
P.O. Box 11012
3rd Floor Akai House, Osu
Accra North
+233 (21) 77 89 13
+233 (21) 701 06 20

Greece
Mercury S.A.
6, Loukianou Str.
10675 Athens
+302 (10) 722 92 13
+302 (10) 721 51 98
mercury@hol.gr

Guatemala
siehe/see Mexico

Honduras
siehe/see Mexico

Hong Kong
Electronic Scientific Engineering
9/F North Somerset House
Taikoo Place
979 King's Road
Hong Kong
+852 (25) 07 03 33
+852 (25) 07 09 25
stephenchau@ese.com.hk

Hungary
Rohde & Schwarz
Budapesti Iroda
Váci út 169
1138 Budapest
+36 (1) 412 44 60
+36 (1) 412 44 61
rs-hungary@rshu.rohde-schwarz.com

Iceland
siehe/see Denmark

India
Rohde & Schwarz India Pvt. Ltd.
Bangalore Office
No. 24, Service Road, Domlur
2nd Stage Extension
Bangalore - 560 071
+91 (80) 535 23 62
+91 (80) 535 03 61
rsindiab@rsnl.net

India
Rohde & Schwarz India Pvt. Ltd.
Hyderabad Office
302 & 303, Millenium Centre
6-3-1099/1100, Somajiguda
Hyderabad - 500 016
+91 (40) 23 32 24 16
+91 (40) 23 32 27 32
rsindiah@nd2.dot.net.in

India
Rohde & Schwarz India Pvt. Ltd.
RS India Mumbai Office
B-603, Remi Bizcourt, Shah Industrial Estate, Off Veera Desai Road
Mumbai - 400 058
+91 (22) 26 30 18 10
+91 (22) 26 73 20 81
rsindiam@rsnl.net

Indonesia
PT Rohde & Schwarz Indonesia
Graha Paramita 5th Floor
Jln. Denpasar Raya Blok D-2
Jakarta 12940
+62 (21) 252 36 08
+62 (21) 252 36 07
sales@rsbj.rohde-schwarz.com
services@rsbj.rohde-schwarz.com

Adressen/Addresses

Iran

Rohde & Schwarz Iran
Groundfloor No. 1, 14th Street
Khaled Eslamboli (Vozara) Ave.
15117 Tehran
+98 (21) 872 42 96
+98 (21) 871 90 12
rs-tehran@neda.net

Ireland

siehe/see United Kingdom

Israel

Eastronics Ltd.
Messtechnik/T&M Equipment
11 Rozanis St.
P.O.Box 39300
Tel Aviv 61392
+972 (3) 645 87 77
+972 (3) 645 86 66
david_hasky@easx.co.il

J.M. Moss (Engineering) Ltd.
Kommunikationstechnik/ Communications Equipment
9 Oded Street
P.O.Box 967
52109 Ramat Gan
+972 (3) 631 20 57
+972 (3) 631 40 58
jmmoss@zahav.net.il

Italy

Rohde & Schwarz Italia S.p.a.
Centro Direzionale Lombardo
Via Roma 108
20060 Cassina de Pecchi (MI)
+39 (02) 95 70 42 03
+39 (02) 95 30 27 72
ornella.crippa@rsi.rohde-schwarz.com

Rohde & Schwarz Italia S.p.a.
Via Tiburtina 1182
00156 Roma
+39 (06) 41 59 82 18
+39 (06) 41 59 82 70

Japan

Rohde & Schwarz
Support Center Japan K.K.
711 bldg., Room 501 (5th floor)
7-11-18 Nishi-Shinjuku
Shinjuku-ku
Tokyo 160-0023
+81 (3) 59 25 12 88
+81 (3) 59 25 12 90

Advantest Corp.
Sales Promotion Department
Shinjuku-NS bldg.
2-4-1, Nishi-Shinjuku
Shinjuku-ku
Tokyo 160-0880
+81 (3) 33 42 75 52
+81 (3) 53 22 72 70
mkoyama@ns.advantest.co.jp

Jordan

Jordan Crown Engineering & Trading Co.
Jabal Amman, Second Circle
Youssef Ezzideen Street
P.O.Box 830414
Amman, 11183
+962 (6) 462 17 29
+962 (6) 465 96 72
jocrown@go.com.jo

Kazakhstan

Rohde & Schwarz Kazakhstan
Representative Office Almaty
Pl. Respubliki 15
480013 Almaty
+7 (32) 72 67 23 54
+7 (32) 72 67 23 46
rs-kazakhstan@rus-rohde-schwarz.com

Kenya

Excel Enterprises Ltd
Dunga Road
P.O.Box 42 788
Nairobi
+254 (2) 55 80 88
+254 (2) 54 46 79

Korea

Rohde & Schwarz Korea Ltd.
83-29 Nonhyun-Dong, Kangnam-Ku
Seoul 135-010
+82 (2) 3485 1900
+82 (2) 3485 1900
sales@rskor.rohde-schwarz.com
service@rskor.rohde-schwarz.com

Kuwait

Group Five Trading & Contracting Co.
Mezanine Floor
Al-Bana Towers
Ahmad Al Jaber Street
Sharq
+965 (244) 91 72/73/74
+965 (244) 95 28
jk_agarwal@yahoo.com

Latvia

Rohde & Schwarz Danmark A/S
Latvian Branch Office
Merkela iela 21-301
1050 Riga
+371 (7) 50 23 55
+371 (7) 50 23 60
rsdk@rsdk.rohde-schwarz.com

Lebanon

Rohde & Schwarz
Liaison Office Riyadh
P.O.Box 361
Riyadh 11411
+966 (1) 465 64 28 Ext. 303
+966 (1) 465 64 28 Ext. 229
chris.porzky@rsd.rohde-schwarz.com

Lebanon

Netcom
P.O.Box 55199
Op. Ex-Presidential Palace
Horsh Tabet
Beirut
+961-1-48 69 99
+961-1-49 05 11
netcom@inco.com.lb

Liechtenstein

siehe/see Switzerland

Lithuania

Rohde & Schwarz Danmark A/S
Lithuanian Office
Lukiskiu 5-228
2600 Vilnius
+370 (5) 239 50 10
+370 (5) 239 50 11

Luxembourg

siehe/see Belgium

Macedonia

siehe/see Slovenia

Malaysia

Dagang Teknik Sdn. Bhd.
No. 9, Jalan SS 4D/2
Selangor Darul Ehsan
47301 Petaling Jaya
+60 (3) 27 03 55 68
+60 (3) 27 03 34 39
maryanne@danik.com.my

Malta

ITEC International Technology Ltd
B'Kara Road
San Gwann SGN 08
+356 (21) 37 43 00 or 37 43 29
+356 (21) 37 43 53
sales@itec.com.mt

Mexico

Rohde & Schwarz de Mexico
Av. Prol. Americas No. 1600, 2° Piso
Col. Country Club
Guadalajara, Jal.
Mexico CP, 44610
+52 (33) 36 78 91 70
+52 (33) 36 78 92 00

Rohde & Schwarz de Mexico
S. de R.L. de C.V.
German Centre Oficina 4-2-2
Av. Santa Fé 170
Col. Lomas de Santa Fé
01210 Mexico D.F.
+52 (55) 85 03 99 13
+52 (55) 85 03 99 16
latinoamerica@rsd.rohde-schwarz.com

Moldavia

siehe/see Romania

Nepal

ICTC Pvt. Ltd.
Hattisar, Post Box No. 660
Kathmandu
+977 (1) 443 48 95
+977 (1) 443 49 37
ictc@mos.com.np

Netherlands

Rohde & Schwarz Nederland B.V.
Perkinsbaan 1
3439 ND Nieuwegein
+31 (30) 600 17 00
+31 (30) 600 17 99
info@rsn.rohde-schwarz.com

New Zealand

Nichecom
1 Lincoln Ave.
Tawa, Wellington
+64 (4) 232 32 33
+64 (4) 232 32 30
rob@nichecom.co.nz

Nicaragua

siehe/see Mexico

Nigeria

Ferrostaal Abuja
Plot 3323, Barada Close
P.O.Box 8513, Wuse
Off Amazon Street
Maitama, Abuja
+234 (9) 413 52 51
+234 (9) 413 52 50
fsabuja@rosecom.net

Norway

Rohde & Schwarz Norge AS
Enebakkveien 302 B
1188 Oslo
+47 (23) 38 66 00
+47 (23) 38 66 01

Oman

Mustafa Sultan Science & Industry Co.LLC.
Test & Measurement Products
Way No. 3503
Building No. 241
Postal Code 112
Al Khuwair, Muscat
+968 63 60 00
+968 60 70 66
m-aziz@mustafasultan.com

Pakistan

Siemens Pakistan
23, West Jinnah Avenue
Islamabad
+92 (51) 227 22 00
+92 (51) 227 54 98
reza.bokhary@siemens.com.pk

Adressen/Addresses

Panama siehe/see Mexico

Papua New Guinea siehe/see Australia

Philippines
Rohde & Schwarz (Philippines) Ltd.
PBCom Tower
Ayala Ave. cor. Herrera Sts.
Makati City
+63 (2) 755 88 70
+63 (2) 755 88 67

Poland
Rohde & Schwarz SP.z o.o.
Przedstawicielstwo w Polsce
ul. Stawki 2, Pietro 28
00-193 Warszawa
+48 (22) 860 64 94
+48 (22) 860 64 99
rs-poland@rspl.rohde-schwarz.com

Portugal
Rohde & Schwarz Portugal, Lda.
Alameda Antonio Sergio
7-R/C - Sala A
2795-023 Linda-a-Velha
+351 (21) 415 57 00
+351 (21) 415 57 10
info@rspt.rohde-schwarz.com

Romania
Rohde & Schwarz
Representation Office Bucharest
Str. Uranus 98
Sc. 2, Et. 5, Ap. 36
76102 Bucuresti, Sector 5
+40 (21) 410 68 46
+40 (21) 411 20 13
rs-romania@rsro.rohde-schwarz.com

Russian Federation
Rohde & Schwarz
Representative Office Moscow
119180, Yakimanskaya nab., 2
Moscow
+7 (095) 745 88 50 to 53
+7 (095) 745 88 54
rs-russia@rsru.rohde-schwarz.com

Saudi Arabia
Rohde & Schwarz Liaison Office Riyadh
c/o Haji Abdullah Alireza Co. Ltd.
P.O.Box 361
Riyadh 11411
+966 (1) 465 64 28 Ext. 303
+966 (1) 465 6428 Ext. 229
chris.porzky@rsd.rohde-schwarz.com

Saudi Arabia
Gentec
Haji Abdullah Alireza & Co. Ltd.
P.O.Box 43054
Riyadh
+966 (1) 465 64 28
+966 (1) 465-64 28
akanbar@gentec.com.sa

Serbia-Montenegro
Representative Office Belgrade
Tose Jovanovica 7
11030 Beograd
+381 (11) 305 50 25
+381 (11) 305 50 24

Singapore
Rohde & Schwarz
Regional Headquarters Singapore Pte. Ltd.
1 Kaki Bukit View
#05-01/02 Techview
Singapore 415 941
+65 (6) 846 1872
+65 (6) 846 1252
rsca@rssg.rohde-schwarz.com

Slovak Republic
Specialne systemy a software, a.s.
Svrcia ul.
841 04 Bratislava
+421 (2) 65 42 24 88
+421 (2) 65 42 07 68
stefan.lozek@special.sk

Slovenia
Rohde & Schwarz
Representation Ljubljana
Tbilisijska 89
1000 Ljubljana
+386 (1) 423 46 51
+386 (1) 423 46 11
rs-slovenia@rssi.rohde-schwarz.com

South Africa
Protea Data Systems (Pty.) Ltd.
Communications and Measurement Division
Private Bag X19
Bramley 2018
+27 (11) 719 57 00
+27 (11) 786 58 91
unicm@protea.co.za

South Africa
Protea Data Systems (Pty.) Ltd.
Cape Town Branch
Unit G9, Centurion Business Park
Bosmandam Road
Milnerton
Cape Town, 7441
+27 (21) 555 36 32
+27 (21) 555 42 67
unicm@protea.co.za

Spain
Rohde & Schwarz Espana S.A.
Salcedo, 11
28034 Madrid
+34 (91) 334 10 70
+34 (91) 329 05 06
rses@rses.rohde-schwarz.com

Sri Lanka
Dynatel Communications (PTE) Ltd.
451/A Kandy Road
Kelaniya
+94 (1) 90 80 01
+94 (1) 91 04 69
dyna-svc@sltnet.lk

Sudan
SolarMan Co. Ltd.
P.O.Box 11 545
North of Fraouq Cementry 6/7/9 Bldg. 16
Karthoum
+249 (11) 47 31 08
+249 (11) 47 31 38
solarman29@hotmail.com

Sweden
Rohde & Schwarz Sverige AB
Marketing Div.
Flygfältsgatan 15
128 30 Skarpnäck
+46 (8) 605 19 00
+46 (8) 605 19 80
info@rss.se

Switzerland
Roschi Rohde & Schwarz AG
Mühlestr. 7
3063 Ittigen
+41 (31) 922 15 22
+41 (31) 921 81 01
sales@roschi.rohde-schwarz.com

Syria
Electro Scientific Office
Baghdad Street
Dawara Clinical Lab. Bldg
P.O.Box 8162
Damascus
+963 (11) 231 59 74
+963 (11) 231 88 75
memo@hamshointl.com

Taiwan
Rohde & Schwarz Taiwan (Pvt.) Ltd.
Floor 14, No. 13, Sec. 2, Pei-Tou Road
Taipei 112
+886 (2) 28 93 10 88
+886 (2) 28 91 72 60
celine.tu@rstw.rohde-schwarz.com

Tanzania
SSTL Group
P.O. Box 7512
Dunga Street Plot 343/345
Dar es Salaam
+255 (22) 276 00 37
+255 (22) 276 02 93
sstl@ud.co.tz

Thailand
Schmidt Electronics (Thailand) Ltd.
63 Government Housing Bank Bldg.
Tower II, 19th floor, Rama 9 Rd.
Huaykwang, Bangkapi
Bangkok 10320
+66 (2) 643 13 30 to 39
+66 (2) 643 13 40
kamthoninthuyot@schmidtthailand.com

Trinidad &Tobago siehe/see Mexico

Tunisia
Teletek
71, Rue Alain Savary
Residence Alain Savary (C64)
1003 Tunis
+216 (71) 77 22 88
+216 (71) 77 05 53

Turkey
Rohde & Schwarz International GmbH
Liaison Office Istanbul
Bagdad Cad. 191/3, Arda Apt. B-Blok
81030 Selamicesme-Istanbul
+90 (216) 385 19 17
+90 (216) 385 19 18
rsturk@superonline.com

Ukraine
Rohde & Schwarz
Representative Office Kiev
4, Patris Loumoumba ul
01042 Kiev
+38 (044) 268 60 55
+38 (044) 268 83 64
rsbkiev@public.ua.net

United Arab Emirates
Rohde & Schwarz International GmbH
Liaison Office Abu Dhabi
P.O. Box 31156
Abu Dhabi
+971 50 62 40 197
+971 (4) 3944 794
michael.rogler@rsd.rohde-schwarz.com

United Arab Emirates
Rohde & Schwarz Bick Mobile Communication
P.O.Box 17466
Dubai
+971 (4) 883 71 35
+971 (4) 883 71 36

United Arab Emirates
Rohde & Schwarz Emirates L.L.C.
Ahmed Al Nasri Building, Mezzanine Floor,
P.O.Box 31156
Off old Airport Road
Behind new GEMACO Furniture
Abu Dhabi
+971 (2) 631 20 40
+971 (2) 631 30 40
rsuaeam@emirates.net.ae

Adressen/Addresses

United Kingdom	Rohde & Schwarz UK Ltd. Ancells Business Park Fleet Hampshire GU 51 2UZ England	+44 (1252) 81 88 88 (sales) +44 (1252) 81 88 18 (service) +44 (1252) 81 14 47 sales@rsuk.rohde-schwarz.com
Uruguay	Aeromarine S.A. Cerro Largo 1497 11200 Montevideo	+598 (2) 400 39 62 +598 (2) 401 85 97 mjn@aeromarine.com.uy
USA	Rohde & Schwarz, Inc. Broadcast & Comm. Equipment 8661-A Robert Fulton Drive Columbia, MD 21046-2265	+1 (410) 910 78 00 +1 (410) 910 78 01 rsatv@rsa.rohde-schwarz.com rsacomms@rsa.rohde-schwarz.com
USA	Rohde & Schwarz, Inc. Marketing & Support Center/T&M Equipment 2540 SW Alan Blumlein Way M/S 58-925 Beaverton, OR 97077-0001	+1 (503) 627 26 84 +1 (503) 627 25 65 info@rsa.rohde-schwarz.com
USA	Rohde & Schwarz, Inc. Systems & EMI Products 8080 Tristar Drive Suite 120 Irving, Texas 75063	+1 (469) 713 53 00 +1 (469) 713 53 01 info@rsa.rohde-schwarz.com
Venezuela	Equilab Telecom C.A. Centro Seguros La Paz Piso 6, Local E-61 Ava. Francisco de Miranda Boleita, Caracas 1070	+58 (2) 12 34 46 26 +58 (2) 122 39 52 05 r_ramirez@equilabtelecom.com
Venezuela	Representaciones Bopic S.A. Calle C-4 Qta. San Jose Urb. Caurimare Caracas 1061	+58 (2) 129 85 21 29 +58 (2) 129 85 39 94 incotr@cantv.net
Vietnam	Schmidt Vietnam Co. (H.K.) Ltd., Representative Office Hanoi Intern. Technology Centre 8/F, HITC Building 239 Xuan Thuy Road Cau Giay, Tu Liem Hanoi	+84 (4) 834 61 86 +84 (4) 834 61 88 svnhn@schmidtgroup.com
West Indies	siehe/see Mexico	

Service and Repair

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

- Instrument model
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Rohde & Schwarz offers the following calibrations:

- Calibration on R&S-type test systems. The calibration documentation meets the requirements of the quality management system ISO 9000.
- Calibration at an R&S calibration center approved by the German Calibration Service (DKD). The calibration documentation consists of the DKD calibration certificate.

Refer to Chapter 5 for a detailed description on shipping of the instrument and ordering of spare parts.

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1 Performance Test

Test Instructions

- The rated specifications of the analyzer are tested after a warm-up time of at least 15 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured. Starting of overall adjustment: [***CAL** : CAL TOTAL*]
- If nothing else is specified, all measurements will be done with external reference frequency.
- Values given in the following sections are not guaranteed. Only the technical specifications of the data sheet are binding.
- The values given in the datasheet are the guaranteed limits. Due to measurement errors these limits must be extended by the tolerance of the measuring equipment used in this performance test.
- Inputs for settings during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, eg **[SPAN]**

  [<SOFTKEY>] Press a softkey, eg [MARKER -> PEAK]

  [**<nn unit>**] Enter a value and terminate by entering the unit, eg [**12 kHz**]

  Successive entries are separated by [:], eg. [**BW** : RES BW MANUAL : **3 kHz**]

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	accuracy < $1x10^{-9}$, frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency accuracy of reference oscillator
2	Signal generator	FSQ3 / FSQ8: 10 MHz to 13 GHz FSQ26: 10 MHz to 26.5 GHz	SMP02 SMP03	1035.5005.02 1035.5005.03	Immunity to interference Third-Order Intercept Frequency response
3	Signal generator	1 MHz to 3.6 GHz Phase noise at 640 MHz: < -100 dBc(1 Hz) @ 100 Hz < -115 dBc(1 Hz) @ 1 kHz < -127 dBc(1 Hz) @ 10 kHz < -130 dBc(1 Hz) @ 100 kHz < -142 dBc(1 Hz) @ 1 MHz 1 MHz to 36 MHz +16 dBm output level	SMHU	0835.8011.52	Calibration source 128 MHz 2nd-Order harmonic dist. Third-Order Intercept IF Filters Frequency response Display linearity RF attenuator Reference level switching Phase Noise Frequency response of IQ-path B71: Frequency response of the base band input
4	Signal generator	FSQ 8: 3.6 GHz to 8 GHz	SMP02	1035.5005.02	Third-Order Intercept
5	3 or 6-dB coupler (power combiner)	FSQ 3: 10 MHz to 3.6 GHz FSQ 8: 10 MHz to 8 GHz FSQ 26: 10 MHz to 26.5 GHz			Third-Order Intercept
6	6-dB divider (power splitter)	level imbalance 10 MHz to 2.2 GHz ≤ 0.10 dB 2.2 GHz to 7 GHz ≤ 0.2 dB 7 GHz to 18 GHz ≤ 0.3 dB 18 GHz to 26.5 GHz ≤ 0.4 dB FSQ 3: 10 MHz to 3.6 GHz FSQ 8: 10 MHz to 8 GHz FSQ 26: 10 MHz to 26.5 GHz			Frequency response B71
7	50-Ohm termination	FSQ 3: 10 MHz to 3,6 GHz FSQ 8: 10 MHz to 8 GHz FSQ 26: 10 MHz to 26.5 GHz	RNA RNA Wiltron 28S50	0272.4510.50 0272.4510.50	Noise display
8	Power meter		NRVD	0857.8008.02	Frequency response B71
9	Power sensor	1 MHz to 3.6 GHz RSS ≤ 0.8 % Meter noise ≤ 20 pW	NRV-Z4 or NRV-Z5	0828.3618.02 0857.9004.02	Frequency response
10	Power sensor	RSS referred to indicated Power: 3.6 GHz to 7 GHz ≤2 % 7 GHz to 26.5 GHz ≤3.5 % FSQ 3: 10 MHz to 3,6 GHz FSQ 8: 3.6 GHz to 8 GHz FSQ 26: 3.6 GHz to 26 GHz FSQ-B71: 1 MHz to 36 MHz at –20 dBm to +10 dBm: ≤1,5 %	NRV-Z2 NRV-Z5	0828.3218.02 08253818.02	Frequency response B71: frequency response

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
11	Step attenuator	variable attenuation 0 dB to 100 dB, 1-dB steps attenuation accuracy < 0.1 dB (f = 5 MHz)	RSP	0831.3515.02	Reference level switching, Display linearity, RF attenuator
12	Attenuator (2 x)	fixed attenuation 10 dB FSQ 3: 10 MHz to 3.6 GHz FSQ 8:: 10 MHz to 8 GHz	 DNF DNF	 0272.4210.50 0272.4210.50	Third-Order Intercept
13	Low pass	cut-off frequency: 28 MHz, 107 MHz, 262 MHz, 640 MHz, 1000 MHz, 1700 MHz	ATS-OW	1000.1755.20	2nd--order harmonic distortion.
14	VSWR-Bridge	directtivity >30 dB FSQ 3 : 10 MHz to 3,6 GHz FSQ 8: 10 MHz to 8 GHz	ZRC Wiltron 87A50 with adapter 34AN50, Open/Short 22NF50	1039.9492.55	VSWR FSQ 3 and FSQ 8
15	Network Analyzer	FSQ 26: 10 MHz to 26.5 GHz	ZVK		VSWR FSQ 26, or as alternative to 14
16	IQ-Base Band Generator	Frequency range up to 10 MHz 2 sinusoidal signals with 90 deg phase difference	AMIQ	1110.2003.03	B9: test of modulation
17	Volt meter	DC and AC voltage	URE02 URE03	0350.5315.02 0350.5315.03	B9: test of modulation
18	N cable	attenuation < 0.2 dB up to 3.6 GHz			B9/B12: test of output level
19	Spectrum Analyzer	Frequency range up to 3,6 GHz	FSU 3	1129.9003.03	B9: test of modulation
20	WinIQSIM	PC test program for AMIQ			B9: Generation of data for modulation test.
21	Software: Modulation test 100 kHz	Setup files for AMIQ with modulated signal 100 kHz		1142.9232.00	B9: test FM
22	Software modulation test 1 MHz + 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with + 90 deg phase shift between I- and Q- channel		1142.9249.00	B9: test AM; Test of I/Q-modulation with + 90 deg phase shift
23	Software modulation test 1 MHz - 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with - 90 deg phase shift between I- and Q- channel		1142.9255.00	B9: test AM; Test of I/Q-modulation with – 90 deg phase shift
24	PC	Windows, LAN and RSIB SW or GPIB interface			Frequency Response of IQ-path B9, B71
25	4 x 50 Ω termination	BNC, 50 Ω ± 0,1 %	RAD50	0844.9352.02	B71: all 1kΩ measurements and noise display via FSQ-B71 (base band inputs)

Performance Test FSQ

Checking the Reference Frequency Accuracy

Test equipment:

Frequency counter (Section "Measurement Equipment", item 1):
Accuracy < $1x10^{-9}$
Frequency range up to 10 MHz

Test setup:

➢ Connect frequency counter to 10-MHz reference output of the FSQ (rear panel)

FSQ settings:

- [**SETUP** : REFERENCE INT / EXT]
➢ Toggle to internal reference (INT)

Measurement:

➢ Measure frequency with frequency counter

Nominal frequency:
Model without option B4..... 10 MHz ± 1 Hz
Model with option B4 .....10 MHz ± 0.3Hz

Note:

The frequency of the reference oscillator can be adjusted by means of a service function (see chapter "Adjustment")

Checking Immunity to Interference

Test equipment:

Signal generator (Section "Measurement Equipment", item 2):

Frequency range	FSQ 3:	10 MHz to 13 GHz
	FSQ 8:	10 MHz to 13 GHz
	maximum level	≥ 0 dBm

Test setup:

➢ Connect RF output of the signal generator to RF input.

Signal generator settings:

Level: adjust the output level of signal generator for an RF-Input level of 0 dBm

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : REF LEVEL : **-30 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]

1st IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 9256.8 MHz

Additional FSQ settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}

Measurement:
- Set marker to peak of signal
  [**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):
Image frequency rejection = 0dBm – L_{dis}

2nd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 808.8 MHz

Additional FSQ settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement:
- Set marker to peak of signal
  [**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):
Image frequency rejection = 0dBm – L_{dis}

3rd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 40.8 MHz

Additional FSQ settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement:
- Set marker to peak of signal
  [**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):
Image frequency rejection = 0dBm – L_{dis}

1st IF Rejection

Additional signal generator settings: - Frequency 4628.4 MHz

Additional FSQ settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement: ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = 0dBm – L_{dis}

2nd IF Rejection

Additional signal generator settings: - Frequency 404.4 MHz

Additional FSQ settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement: ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = 0dBm – L_{dis}

Checking Nonlinearities

Third-Order Intercept Point

Test equipment:

- 2 signal generators
  - FSQ 3: Section "Measurement Equipment", item 2 and 3
  - FSQ 8, FSQ 26 Section "Measurement Equipment", item 2, 3, 4
  - Frequency range:
    - FSQ 3: 10 MHz to 3.6 GHz
    - FSQ 8: 10 MHz to 8 GHz
    - FSQ 26: 10 MHz to 26.5 GHz

- 2 attenuators (Section "Measurement Equipment", item 12)
  - Attenuation a_{ATT} = 10 dB
  - Frequency range
    - FSQ 3: 10 MHz to 3.6 GHz
    - FSQ 8: 10 MHz to 8 GHz
    - FSQ 26: 10 MHz to 26.5 GHz

- Power combiner (Section "Measurement Equipment", item 5)
  - Frequency range
    - FSQ 3: 10 MHz to 3.6 GHz
    - FSQ 8: 10 MHz to 8 GHz
    - FSQ 26: 10 MHz to 26.5 GHz

Test setup:

- Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the combiner
- Connect output of the combiner to the RF input of the FSQ.

Signal generator settings: (both generators)

- Frequency: generator 1 $f_{g1} = f_{in} - 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz

See table of performance test report for values of f_{in}

- Adjust the output level of the signal generators for an input level at the FSQ of –10 dBm.
- Switch off the ALC of the generators to reduce the interference between the generators

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}

Measurement

- [**MKR FCTN** : TOI]

Evaluation:

The third order intercept point (T.O.I) referred to the input signal is displayed in the marker field by the reading [TOI].

Second-Order Harmonic Distortion

Test equipment:

➢ - Signal generator (Section "Measurement Equipment", item 3)

➢ Frequency range: 9 kHz to 1.8 GHz

Recommended harmonic suppression:

f <100 MHz :	>35 dBc
100 MHz < f < 1 GHz :	>45 dBc
f >1 GHz :	>35 dBc

In order to improve the harmonic suppression of the generator it is recommended to insert a lowpass filter with a suitable cut-off frequency (Section "Measurement Equipment", item 13) after the generator.

Test setup:

➢ Connect RF output of signal generator to the input of the lowpass

➢ Connect the output of the lowpass to the RF input of the FSQ

Note:

If the harmonic suppression of the signal generator is sufficient, the lowpass can be left out.
The RF output of the generator can be connected directly to the RF input of the FSQ *in this case.*

Signal generator settings:

- Level: 0 dBm
- Frequency: f_{in}

see table of performance test report for values of f_{in}

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **3 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**FREQ** : CENTER : { f_{in} }]

See table of performance test report for values of f_{in}

Measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The level of the input signal L_{IN} is displayed by the marker reading for marker 1.

➢ Set center frequency of the FSQ to the frequency of the 2nd harmonic
- [**FREQ** : CENTER : {2 x f_{in}}]

Measurement:

➢ Set marker to peak of the 2nd harmonic
- [**MKR** ⇒ : PEAK]

The level of the harmonic signal L_{K2} is displayed by the marker reading for marker 1.

Evaluation:

The second order harmonic distortion can be calculated as

$$IP_{k2} / dBm = (L_{IN} - L_{K2}) + L_{IN}$$

Checking IF Filters

Test equipment: Signal generator (Section "Measurement Equipment", item 3):
Frequency 128 MHz
Level ≥ 0 dBm

Test setup: ➢ Connect RF output of the signal generator to the RF input of the FSQ.

Checking the bandwidth switching level accuracy

Reference measurement (RBW 10 kHz)

Signal generator settings:
- Frequency: 128 MHz
- Level: -30 dBm

FSQ settings:
- [**PRESET**]
- [**AMPT** : **-30 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **5 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : RBW MANUAL : **10** : **kHz**]

Reference measurement:
➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Checking the level accuracy

FSQ settings:
- [**SPAN** : {0.5 x RBW}]
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

Note:
To check the FFT- filter, the resolution bandwidth has to be set manually to FFT mode.

- [**BW** : BW MODE : FFT]

Measurement:
➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The level difference is displayed in the marker field by the reading ´Delta [T1 FXD] {xxx} dB´.

Checking Bandwidth

Signal generator settings:
- Frequency: 128 MHz
- Level: -10 dBm

FSQ settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **3** : **ENTER**]

➢ Determine 3-dB-Bandwith
- [**MKR FCTN** : N DB DOWN : **3 dB**]
- [**SPAN** : {3 x RBW}]

See table of performance test report for values of RBW.

Note:

To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz

Measurement:
- [**MKR** ⇒ : PEAK]

The 3 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Checking the Shape Factor

Note: *To check the shape factor the values of the 3 dB bandwith will be needed. Please check before this measurement.*

Signal generator settings:
- Frequency: 128 MHz
- Level: 0 dBm

FSQ settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **20 ENTER**]
- [**BW** : COUPLING RATIO : RBW/VBW NOISE [10]]
- [**MKR FCTN** : N DB DOWN : **60 dB**]
- [**SPAN** : {20 x RBW}]

See table of performance test report for values of RBW.

Note:

To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz

Measurement:
- [**MKR** ⇒ : PEAK]

The 60 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Evaluation:

The shape factor is calculated by BW (60dB) / BW (3dB).

Checking Noise Display

Test equipment: 50 Ω termination (Section "Measurement Equipment", item 7)
Frequency range

FSQ 3:	DC to 3.6 GHz
FSQ 8:	DC to 8 GHz
FSQ 26:	DC to 26.5 GHz

Test setup:
- Terminate the RF input of the FSQ with 50 Ω

FSQ settings:

Measurement for $f_n \leq 1$ kHz:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **10 Hz**]
- [**BW** : BW MODE : **FFT**]
- [**BW** : RES BW MANUAL : **10 Hz**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]

Measurement for f_n >1 kHz:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [SPAN : 0 Hz]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : **Mean**]

See table below for values of RefLev.

See table of performance test report for values of f_n.

Measurement:
- Set the marker to the center frequency for the value below or equal 1 kHz.
- Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –20 dB for the ratio of 10 Hz / 1 kHz .

Note: For example the DANL in 1 kHz bandwidth –126 dBm results in a corrected value of –146 dBm in 10 Hz bandwidth.
As both filter designs are digitally and using the same hardware setting, the DANL can be measured also with 1 kHz bandwidth to reduce measurement time.

Evaluation: The noise level is displayed by the level reading of marker 1.

Frequency	< 10kHz	< 100kHz	< 1MHz	< 10MHz	> 10kHz
RefLev	-10 dBm	-20 dBm	-30 dBm	-60 dBm	-60 dBm

Checking the Level accuracy and the Frequency Response

Test equipment:

- Signal generator :
  FSQ 3: Section "Measurement Equipment", item 3
  FSQ 8 / FSQ 26 Section "Measurement Equipment", item 3 and 4

  Frequency range FSQ 3: to 3.6 GHz
  FSQ 8: to 8 GHz

  Maximum level ≥ 0 dBm

- Power meter (Section "Measurement Equipment", item 8)

- Power sensor :
  FSQ 3: Section "Measurement Equipment", item 9
  FSQ 8 / FSQ 26: Section "Measurement Equipment", item 9 and 10

  Impedance Z = 50 Ω

- 6 dB divider (Section "Measurement Equipment", item 6)

  Frequency range FSQ 3: to 3.6 GHz
  FSQ 8: to 8 GHz
  FSQ 26: to 26.5 GHz

  Level imbalance[1]) 1 MHz to 3.6 GHz ≤ 0.1 dB
  3.6 GHz to 8 GHz ≤ 0.2 dB

  [1]) If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

Determining the level accuracy at 128 MHz

Test setup:

- ➢ Connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor
- ➢ Connect power sensor to RF output of signal generator

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

- ➢ Determine output power of the signal generator with the power meter
- ➢ Connect RF output of the signal generator to RF input of the FSQ

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-30 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

➢ Set marker to peak of signal

- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the FSQ (level reading of marker 1) reflects the absolute level accuracy of the FSQ. It can be calculated as:

$$\text{Level accuracy}_{128\text{MHz}} = L_{\text{FSQ}} - L_{\text{powermeter}}$$

Checking the frequency response

Test setup:

- ➢ Connect RF output of the signal generator to input of the divider
- ➢ Connect output 1 of the divider to the power sensor / power meter
- ➢ Connect output 2 of the divider to RF input of the FSQ

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement:

- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level L_{FSQ} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSQ} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

See table of performance test report for values of f_{fresp}

Power meter settings:

Determine signal level $L_{powermeter}$. To achive higher accuracy it is recommended to compensate the frequency response of the power sensor.

FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]

See table of performance test report for values of f_{fresp}

- ➢ - Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level $_{LFSQ}$ is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = L_{FSQ} - L_{powermeter} - Ref_{128\ MHz}$$

Checking the Display Linearity

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency 5 MHz [1)1)]
  Maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  Frequency 5 MHz [1)]
  Attenuation 0 to 100 dB in 1 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator

➢ Connect RF output of the step attenuator to RF input of the FSQ

Signal generator settings:

- Frequency 5 MHz [1)]
- Level +10 dBm

Step attenuator settings:

Attenuation 20 dB

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** :CENTER : **5 MHz**]
- [**SPAN** : **0 Hz**]
- [**TRACE** : DETECTOR : RMS]

1. Measurement:
- [**BW** : RES BW MANUAL : **500 Hz**]

2. Measurement:
- [**BW** : RES BW MANUAL : **300 kHz**]

3. Measurement:
- [**BW** : RES BW MANUAL : **20 MHz**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings:

Attenuation $\{a_{ATT}\}$

See table of performance test report for values of a_{ATT}.

Evaluation:

The difference between the level of the input signal of the FSQ and the reference (about 10 dB below the reference level) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

[1)] A frequency between 5 MHz and 1 GHz may be used. It is recommended to use correction values for the uncertainty of the attenuator.

Checking the RF Attenuator

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 0 dBm

- Step attenuator (Section "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator
➢ Connect RF output of the step attenuator to RF input of the FSQ

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings:

Attenuation 70 dB

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-30 dBm**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings:

Attenuation { 80dB - a_{FSQ} }
See table below for values of a_{ATT}.

FSQ settings:

- [**AMPT** : RF ATTEN MANUAL : { a_{FSQ} }]
- [**AMPT** : {-40dBm + a_{FSQ} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{FSQ} , a_{ATT} and reference level.

Evaluation:

The difference between the level of the input signal of the FSQ and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading Delta [T1 FXD].

a_{ATT}	80 dB	75 dB	70 dB	60 dB	40 dB
a_{FSQ}	0 dB	5 dB	10 dB	20 dB	40 dB
reference level	-40 dBm	-35 dBm	-30 dBm	-20 dBm	0 dBm

Checking the Reference Level Switching (IF-Gain)

Test principle:

The IF gain of the FSQ can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain accuracies to be mixed up with the log amplifier accuracy it is determined by comparison using an external precision attenuator.

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 5 MHz
  maximum level ≥ -10 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  frequency 5 MHz
  attenuation 0 to 60 dB in 1 dB steps
  attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator

➢ Connect RF output of the step attenuator to RF input of the FSQ

Signal generator settings:

- frequency 5 MHz
- level -10 dBm

Step attenuator settings:

Attenuation 20 dB

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **5 MHz**]
- [**SPAN** : **2 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**TRACE** : DETECTOR : RMS]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation $\{a_{ATT}\}$

See table below for values of a_{ATT}.

FSQ settings: - [**AMPT** : {reference level} **dBm**]

See table below for values of reference level.

- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the level of the input signal of the FSQ and the reference (at 10 dB IF-Gain) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

10 dB gain steps:

a_{ATT}	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
reference level	0 dBm	-10 dBm	-20 dBm	-30 dBm	-40 dBm	-50 dBm

1 dB gain steps:

a_{ATT}	20 dB	21 dB	22 dB	23 dB	24 dB	25 dB	26 dB	27 dB	28 dB	29 dB
reference level	-10 dBm	-11 dBm	-12 dBm	-13 dBm	-14 dBm	-15 dBm	-16 dBm	-17 dBm	-18 dBm	-19 dBm

Checking the Phase Noise

Test equipment:

Signal generator (Section "Measurement Equipment", item 3)

Frequency	640 MHz
Level	≥ 0 dBm
Phase Noise at 640 MHz:	< -100 dBc/Hz @ 100 Hz
	< -115 dBc/Hz @ 1 kHz
	< -127 dBc/Hz @ 10 kHz
	< -130 dBc/Hz @ 100 kHz
	< -142 dBc/Hz @ 1MHz

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the FSQ
- ➢ The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

Signal generator settings:

- Frequency 640 MHz
- Level 0 dBm

Fineadjust the frequency of the generator so that the FSQ shows exactly 640 MHz .

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **640 MHz**]
- [**AMPT** : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {span}]
- [**Ext Ref** : **INT**]

Depending on offset, see table below for values of span.

- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**BW** : RBW MANUAL : {RBW}]

Depending on offset, see table below for values of RBW.

- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]

➢ Activate phase noise marker

- [**MKR FCTN**: PHASE NOISE]
- [**FREQ** : CENTER : {640 MHz + offset}]

See table below for values of offset.

- [**AMPT** : {reference level}]

Depending on offset, see table below for values of reference level.

- [**AMPT** : RF ATTEN MANUAL : {a_{FSQ}}]

Depending on offset, see table below for values of a_{FSQ} .

➢ Set phase noise marker
[**MKR :** MARKER 2 : {offset}]

See table below for values of offset.

***Note**: Please make sure not to measure on a spurious signal.*

Evaluation: The phase noise is displayed in the marker field by the reading Delta 2 [T1 PHN].

Phase noise measurement settings				
Offset	**Span**	**RBW**	**Reference level**	**a** $_{FSQ}$
100 Hz	20 Hz	30 Hz	0 dBm	10 dB
1 kHz	200 Hz	100 Hz	0 dBm	10 dB
10 kHz	2 kHz	300 Hz	0 dBm	10 dB
100 kHz	10 kHz	3 kHz	-10 dBm	0 dB
1 MHz	100 kHz	30 kHz	-30 dBm	0 dB

Note: *To obtain a precise measurement of the phase noise at high offsets the level used at the FSQ input is 10 to 30 dB higher than the reference level. To reduce the measurement time the phase noise is measured with a small span around the frequency offset. This prevents the FSQ from being overloaded.*

Checking the Return Loss at the RF Input

Note: For FSQ 3 or FSQ 8 as alternative to the VSWR bridge a network analyzer (item 14a) can be used also. For FSQ 26 it is recommanded to use a network analyzer for better accuracy.

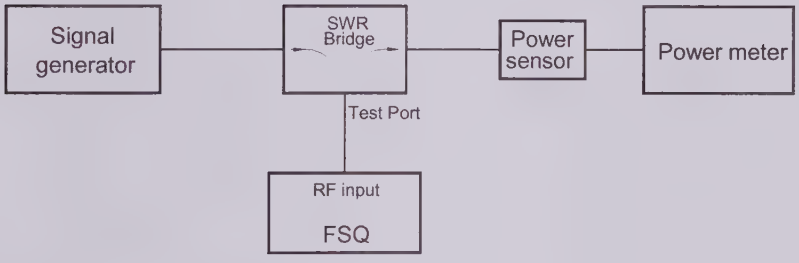
Test equipment:

FSQ 3 / FSQ 8:

- Signal generator (Section "Measurement Equipment", item 2)
  Frequency range FSQ 3: 10 MHz bis 3,6 GHz
  FSQ 8 10 MHz bis 8 GHz
  Level range ≥ -10 dBm
- Power meter (Section "Measurement Equipment", item 8)
- Power sensor
  Frequency range FSQ 3: 10 MHz to 3,6 GHz
  FSQ 8: 10 MHz to 8 GHz
- SWR bridge (Section "Measurement Equipment", item 14)
  Frequency range FSQ 3: 10 MHz to 3,6 GHz
  FSQ 8: 10 MHz to 8 GHz

Test setup:

FSQ 3 / FSQ 8:



FSQ 26 :

Connect the network analyzer to the RF input of the FSQ

Signal generator settings:

- Level -10 dBm
- Frequency {f_{in}}

See performance test report for values of f_{in}.

FSQ settings:

- [**SYSTEM PRESET**]
- [**INPUT** : RF ATTEN MANUAL : **10 dB**]

Calibration:

FSQ 3 / FSQ 8:

➢ Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:

➢ Remove cable from RF input of the FSQ and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level LRef as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

FSQ 3 / FSQ 8:

➢ Connect the RF input of the FSQ to the test port of the SWR bridge.

➢ Measure reflected power L_r with the power meter. The return loss a_r of the RF input of the FSE can be calculated as:

$a_r = L_{Ref} - L_r$.

The VSWR can be calculated as:

$$s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1}$$

FSQ 26:

➢ Determine S_{11} of the FSQ at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about S_{11} measurement.

Checking the frequency response of the IQ compensation filter

As IQ-data are not available in manual mode, checking the compensation of IQ-data path is only possible running a little program on an external PC. Instead of manual settings, GPIB commands for the FSQ are shown in the following table.

Test equipment:
- Signal generator (Section "Measurement Equipment", Item 3)
  - Frequency 128 MHz
  - Max. level ≥0 dBm

Test setup:
Connect RF output of signal generator to RF input of the FSQ.

Signal generator settings:
- Frequency 128 MHz
- Power level 0 dBm at the FSQ

FSQ settings:

```
*RST
FREQ:CENT 128 MHz
INP:ATT 5 dB
DISP:WIND:TRAC:Y:RLEV +3
TRAC:IQ ON
TRAC:IQ:SET NORM, 20 MHz, 40 MHz,IMM,POS,0,40000
FORM REAL,32
TRAC:IQ:DATA?
TRAC:IQ OFF
```

Reference measurement:
Read and calculate the IQ values according to the user handbook, section „Read Trace Data“

- Search for the maximum absolute value of the IQ values

$L_{ref} = \sqrt{}$ (max. $(I_i^2 + Q_i^2)$)

with i = 1 to 40000

Measurement:

FSQ settings:

```
FREQ:CENT 136 MHz
TRAC:IQ ON
TRAC:IQ:SET NORM, 20 MHz, 40 MHz,IMM,POS,0,40000
TRAC:IQ:DATA?
TRAC:IQ OFF
```

1st measured value:
Read and calculate the IQ values according to the user handbook, section „Read Trace Data“

- Search for the maximum absolute value of the IQ values

$L_{136MHz} = \sqrt{}$ (max. $(I_i^2 + Q_i^2)$)

with i = 1 to 40000

FSQ settings:

```
FREQ:CENT 120 MHz
TRAC:IQ ON
TRAC:IQ:SET NORM, 20 MHz, 40 MHz,IMM,POS,0,40000
TRAC:IQ:DATA?
TRAC:IQ OFF
```

2^{nd} measured value:

Read and calculate the IQ values according to the user handbook, section „Read Trace Data“

- Search for the maximum absolute value of the IQ values

$L_{120MHz} = \sqrt{}$ (max. $(I_i^2 + Q_i^2)$)

with i = 1 to 40000

Evaluation:

The frequency response is differences of the measured values of the 1^{st} resp. 2^{nd} measurement to the reference measurement in dB.

F_{resp} at 136 MHz = 20*log10(L_{136}/L_{ref})

F_{resp} at 120 MHz = 20*log10(L_{120}/L_{ref})

Test Procedure Option Tracking Generator - B9 with Option Attenuator - B12

Checking the output level

Test equipment:

- N cable (section "Measurement Equipment", item 18)

Frequency	up to 3.6 GHz
Maximum attenuation	< 0.2 dB

Test setup:

➢ Connect the tracking generator output to the RF input of the FSQ.

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **300 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**TRACE** : AVERAGE : SWEEP COUNT : **10 ENTER]**
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:
{level}: check from 0 dBm to –20 dBm in 5 dB steps

With option B12:
{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm
- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0e (after entering the password)
{level} : check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0

Measurement:

Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Read the value and store it as a reference for the frequency response measurement.

Checking the frequency response

Test equipment:

- N cable (section "Measurement Equipment", item 18)

Frequency	up to 3.6 GHz
Maximum attenuation	< 0.2 dB

Test setup:

Connect the tracking generator output to the RF input of the FSQ.

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [AMPT : RF INPUT DC]
- [**FREQ** : START : **100 kHz**]
- [**FREQ** : STOP : **3.6 GHz**]
- [**BW** : RES BW MANUAL : **30 kHz**]
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:
{level} : check from 0 dBm to –20 dBm in 5 dB steps

With option B12:
{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm
- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0.
{level}: check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0.

Measurement:

Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Set marker to minimum value:
- [**MKR** ⇒ : NEXT : MIN]

Evaluation:

The difference between the min and max of the reference value at 128 MHz yields the frequency response.

Checking the dynamic range

Test equipment:

- N cable (section "Measurement Equipment", item 18)

Frequency	up to 3.6 GHz
Maximum attenuation	< 0.2 dB

Test setup:

Connect the tracking generator output to the RF input of the FSQ.

FSU settings:

- [**PRESET**]
- [**FREQ : 128 MHz**]
- [**SPAN** : ZERO SPAN]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**AMPT** : RANGE LOG MANUAL : **120 dB**]
- [**NETWORK** : SOURCE POWER : **0 dBm**]
- [**MKR** : REFERENCE FIXED]

Disconnect the cable and connect a 50 Ω termination to the tracking generator output and the RF input.

Measurement:

- [**TRACE** : AVERAGE : SWEEP COUNT : **50 ENTER]**

Read off delta marker

Checking Modulation

Checking the I/Q modulator

Test equipment:
- AMIQ (section "Measurement Equipment", item 16)
- Spectrum analyzer (section "Measurement Equipment", item 19)

Test setup:
➢ Connect the the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer. Ensure that the modulation lines are equal (phase shift).

➢ Connect the spectrum analyzer to the tracking generator output.

AMIQ settings
➢ AMIQ self-adjustment
AC voltage I output: U = 0.5 V
AC voltage Q output: U = 0.5 V

Frequency: 1 MHz
Phase (I/Q) = +/-90 degrees
(For this purpose, use AMIQ setup files from section "Measurement Equipment", items 22 and 23.)

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

FSQ settings:
- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION: EXT I/Q]

Measuring the residual carrier:
➢ Switch off the I and Q channels on the AMIQ.

➢ Set marker to peak of signal:

- [**MKR** ⇒ : PEAK]

Read off the measured value on the spectrum analyzer (Marker Peak)

Measuring the impairment (imbalance between the I and Q path):
➢ Switch on the I and Q channels on the AMIQ.
Measure the carrier amplitude at 1 GHz and the lateral component amplitudes at 1 GHz + 1 MHz and 1 GHz - 1 MHz.
Perform this measurement for baseband signals with a phase shift of +90 degrees and –90 degrees between the I and Q channel.

Checking the amplitude modulation

Test equipment:
- AMIQ (section "Measurement Equipment", item 16)
- Spectrum analyzer (section "Measurement Equipment", item 19)

Test setup:
➢ Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.

➢ Connect the spectrum analyzer to the tracking generator output.

AMIQ settings:

➢ AMIQ self-adjustment
AC voltage I output: U = 0.5 V
AC voltage Q output: U = 0 V
Frequency: 1 MHz
(For this purpose, use AMIQ setup files from section "Measurement Equipment", item 22)

Spectrum analyzer settings:

- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

FSQ settings:

- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm]**
- [MODULATION : EXT AM]

Measurement:

➢ Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 1 MHz.

Checking the frequency modulation

Test equipment:

- AMIQ (section "Measurement Equipment", item 16)
- Spectrum analyzer (section "Measurement Equipment", item 19)

Test setup:

➢ Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.

➢ Connect the spectrum analyzer to the tracking generator output.

AMIQ settings:

➢ AC voltage I output: U = 0 V
AC voltage Q output: U = 0.5 V
Frequency: 100 kHz
(For this purpose, use AMIQ setup files from section "Measuring Equipment", item 21)

Spectrum analyzer settings:

- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **1 MHz**]
- [**BW** : **10 kHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

FSQ settings:

- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION : EXT FM : **100 kHz**]

Measurement:

➢ Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 100 kHz.

Performance Test Option Electronic Attenuator- B25

Comment: With FSQ 26 the option B25 is implemented in the signal path below 3.6 GHz. Therefore the measurements are done up to 3.6 GHz only.

Checking Noise Display with Preamplifier (B25)

Test equipment: 50 Ω termination (Section "Measurement Equipment", item 7)
Frequency range: FSQ 3, FSQ 26 to 3.6 GHz
FSQ 8 to 8 GHz

Test setup: ➢ Terminate the RF input of the FSQ with 50 Ω

FSQ settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **10 Hz**]
- [**BW** : VIDEO BW MANUAL : **1 Hz**]
- [**BW** : SWEEP TIME MANUAL : **0.1 s**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : **- 80 dBm**]
- [**SETUP** : PREAMP ON]
- [**FREQ** : CENTER : $\{f_n\}$]

Measurement: ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The noise level is displayed by the level reading of marker 1.

Checking the Level accuracy and the Frequency Response with Preamplifier

Test equipment:

- Signal generator :
  FSQ 3, FSQ 26: Section "Measurement Equipment", item 3
  FSQ 8: Section "Measurement Equipment", item 3 and 4

  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

  Maximum level ≥ 0 dBm

- Power meter (Section "Measurement Equipment", item 8)
- Power sensor :
  FSQ 3, FSQ 26: Section "Measurement Equipment", item 9
  FSQ 8: Section "Measurement Equipment", items 9 and 10

  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

  Maximum power $P_{max} \geq 100\ \mu W$

  Impedance $Z = 50\ \Omega$

- 6 dB divider (Section "Measurement Equipment", item 6)

  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

  Level imbalance[1)] 1 MHz to 1 GHz ≤ 0.1 dB
  1 GHz to 8 GHz ≤ 0.2 dB

[1)] If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

Determining the level accuracy at 128 MHz

Test setup:

➢ Connect power sensor (item 9) to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor

➢ Connect power sensor to RF output of signal generator

Signal generator settings:

- Frequency 128 MHz
- Level -30 dBm

Measurement:

➢ Determine output power of the signal generator with the power meter

➢ Connect RF output of the signal generator to RF input of the FSQ

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-20 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **10 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the FSQ (level reading of marker 1) reflects the absolute level accuracy of the FSQ. It can be calculated as:

$$\text{Level accuracy}_{128\text{MHz}} = L_{\text{FSQ}} - L_{\text{powermeter}}$$

Checking the frequency response

Test setup:

- ➢ Connect RF output of the signal generator to input of the divider
- ➢ Connect output 1 of the divider to the power sensor / power meter
- ➢ Connect output 2 of the divider to RF input of the FSQ

Signal generator settings:

- level 0 dBm
- frequency 128 MHz

FSQ settings

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

Reference measurement:

- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level $_{LFSQ}$ is displayed by the level reading of marker 1.

$$Ref_{128MHz} = {}_{LFSQ} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

See table of performance test report for values of f_{fresp}

Power meter settings:

Determine signal level $L_{powermeter}$. To achive higher accuracy it is recommended to compensate the frequency response of the power sensor.

FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]

See table of performance test report for values of f_{fresp}.

Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level $_{LFSQ}$ is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = {}_{LFSQ} - L_{powermeter} - Ref_{128\ MHz}$$

Checking the Frequency Response with Electronic Attenuator

Test equipment:

- Signal generator :
  FSQ 3, FSQ 26: Section "Measurement Equipment", item 3
  FSQ 8: Section "Measurement Equipment", item 3 and 4

  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

  Maximum level ≥ 0 dBm

- Power meter (Section "Measurement Equipment", item 8)
- Power sensor :
  FSQ 3, FSQ 26: Section "Measurement Equipment", item 9
  FSQ 8: Section "Measurement Equipment", items 9 and 10

  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

  Maximum power $P_{max} \geq 100\ \mu W$

  Impedance $Z = 50\ \Omega$

- 6 dB divider (Section "Measurement Equipment", item 6)

  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

  Level imbalance[1]) 1 MHz to 1 GHz ≤ 0.1 dB
  1 GHz to 8 GHz ≤ 0.2 dB

  [1]) If a power splitter with higher level imbalance is used correction of the measured frequency response is recommended.

Test setup:

- ➢ Connect RF output of the signal generator to input of the divider
- ➢ Connect output 1 of the divider to the power sensor / power meter
- ➢ Connect output 2 of the divider to RF input of the FSQ

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {E_{ATT}} : **dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

See table of performance test report for values of E_{ATT} .

Reference measurement:

- ➢ Determine signal level $L_{powermeter}$.
- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level L_{FSQ} is displayed by the level reading of marker 1.

$$Ref_{128MHz} = L_{FSQ} - L_{powermeter}$$

Measurement

Signal generator settings:

- Frequency f_{fresp}

See table of performance test report for values of f_{fresp}

Power meter settings:

Determine signal level $L_{powermeter}$. To achieve higher accuracy it is recommended to compensate the frequency response of the power sensor.

FSQ settings:

- [**FREQ** : CENTER : {f_{fresp}}]

see table of performance test report for values of f_{fresp}.

Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The signal level L_{FSQ} is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as:

$$\text{Frequency response} = L_{FSQ} - L_{powermeter} - Ref_{128\ MHz}$$

Checking Nonlinearities with Electronic Attenuator

Third-Order Intercept

Test equipment:

- 2 signal generators
  FSQ 3, FSQ 26: Section "Measurement Equipment", item 2 and 3
  FSQ 8: Section "Measurement Equipment", item 2 and 4
  Frequency range:
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz
  Maximum level ≥ 0 dBm

- 2 attenuators (Section "Measurement Equipment", item 12)
  Attenuation a_{ATT} = 10 dB
  Frequency range
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz

- Coupler (Section "Measurement Equipment", item 5)
  Frequency range
  FSQ 3, FSQ 26: 10 MHz to 3.6 GHz
  FSQ 8: 10 MHz to 8 GHz
  Decoupling > 12 dB

Test setup:

- ➢ Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the coupler
- ➢ Connect output of the coupler to the RF input of the FSQ.

Signal generator settings: (both generators)

Frequency: generator 1 $f_{g1} = f_{in} - 100$ kHz
generator 2 $f_{g2} = f_{in} + 100$ kHz

See table of performance test report for values of f_{in}

Adjust the output level of signal generators for an input level at the FSQ of –10 dBm.

FSQ settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement

- ➢ [**MKR FCTN** : TOI]

Evaluation:

The third order intercept point (T.O.I) referred to the input signal is is displayed in the marker field by the reading [TOI].

Checking the RF Attenuator (with Option B25)

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  frequency 128 MHz
  maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:

➢ Connect RF output of the signal generator to RF input of the step attenuator.

➢ Connect RF output of the step attenuator to RF input of the FSQ.

Signal generator settings:

- Frequency 128 MHz
- Level 10 dBm

Step attenuator settings: Attenuation 70 dB

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-35 dBm**]

Reference measurement:

➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement:

Step attenuator settings: Attenuation { 80dB - a_{FSQ} }
See table below for values of a_{ATT}.

, settings:

- [**AMPT** : RF ATTEN MANUAL : {a_{FSQ}}]
- [**AMPT** : {-45dBm + a_{FSQ} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{FSQ} , a_{ATT} and reference level.

Evaluation:

The difference between the level of the input signal of the FSQ and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT} in dB	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
a_{FSQ} in dB	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
Ref.level in dBm	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30

Checking the electronic Attenuator accuracy

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  - Frequency 128 MHz
  - Maximum level ≥ 0 dBm
- Step attenuator (Section "Measurement Equipment", item 11)
  - Frequency 128 MHz
  - Attenuation 0 to 40 dB in 5 dB steps
  - Attenuation accuracy < 0.1 dB

Test setup:

- ➢ Connect RF output of the signal generator to RF input of the step attenuator
- ➢ Connect RF output of the step attenuator to RF input of the FSQ

Signal generator settings:

- Frequency 128 MHz
- Level 0 dBm

Step attenuator settings:

attenuation 40 dB

FSQ settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **- 30 dBm**]

Reference measurement:

- ➢ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
- ➢ Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement:

Step attenuator settings:

Attenuation { 40dB - a_{FSQ} }
See table below for values of a_{ATT}.

FSQ settings:

- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {a_{FSQ}}]
- [**AMPT** : {-30dBm + a_{FSQ} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{FSQ} , a_{ATT} and reference level.

Evaluation:

The difference between the level of the input signal of the FSQ and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT}	40 dB	35 dB	20 dB	25 dB	20 dB	15 dB	10 dB
a_{FSQ}	0 dB	5 dB	10 dB	15 dB	20 dB	25 dB	30 dB
Reference level	-30 dBm	-25 dBm	-20 dBm	-15 dBm	-10 dBm	-5 dBm	0 dBm

Test Procedure for Option IQ Baseband Input FSQ-B71

The baseband input can only be checked using a program on an external PC.

For each measurement, 4096 samples of I/Q data are to be taken from the FSQ to calculate the spectrum by means of the complex FFT. The relevant quantities such as noise, harmonic ratio and level are determined from the spectrum. To obtain an accurate level display, the data must be evaluated with a flattop window before using the FFT algorithm.

```
Flattop window for FFT length 4096

N = 4096

a0 = 0.209671
a1 = -0.407331
a2 = 0.281225
a3 = -0.092669
a4 = 0.009104

phase = [0: (2*π/N): (2*π-(2*π/N))]              /* 4096 values

w = (a0+a1*cos(phase)+a2*cos(2*phase)+a3*cos(3*phase)+a4*cos(4*phase))/a0

(For "phase" 4096 values from 0 to 2π put into the window formula yields
4096 values for w: w1 to w4096. These are to be multiplied with the I and Q
samples #1 to #4096.)
```

This flattop window has a noise bandwidth = 3.88 bins.

The I/Q data is read out with the **TRACe:IQ subsystem** (→ operating manual).
The command sequence is always the same since the parameters for the various baseband measurements are not modified (reads 4096 I/Q pairs of values; sampling rate = 81.6 MHz).

```
TRAC:IQ ON
TRAC:IQ:SET NORM, 10 MHz, 81.6 MHz, IMM, POS, 0, 4096
FORM REAL,32   or  FORM ASCII
TRAC:IQ:DATA?
TRAC:IQ OFF
```

The I/Q data consists of the sampling values in volts.

The complex FFT represents the frequency domain from –fa/2 to +fa/2 (fa = sampling rate). A signal in the channel I or Q alone generates a positive and identical negative spectrum whose power values are to be added together. It is also possible to take only the value at the positive (or negative) frequency and add 3.01dB (multiply with $\sqrt{2}$). This applies to all signals, including noise, except frequency zero. The correction is not required with the DC component since the two spectral lines coincide.
This correction is a prerequisite for the performance test. The specified correction factor for noise does not include these 3 dB.

A **Windows program** is available for manual measurements; this program reads the I/Q data, evaluates it with the flattop window and displays the FFT spectrum. The level can be read out with markers. For noise measurements, averaging can be switched on via a selectable number of FFTs.
The files required for this program can be loaded from "gloris" (https://gloris.rohde-schwarz.com/) as follows:

Firmware/software → software → FSQ-B71 → FSQ I/Q test program

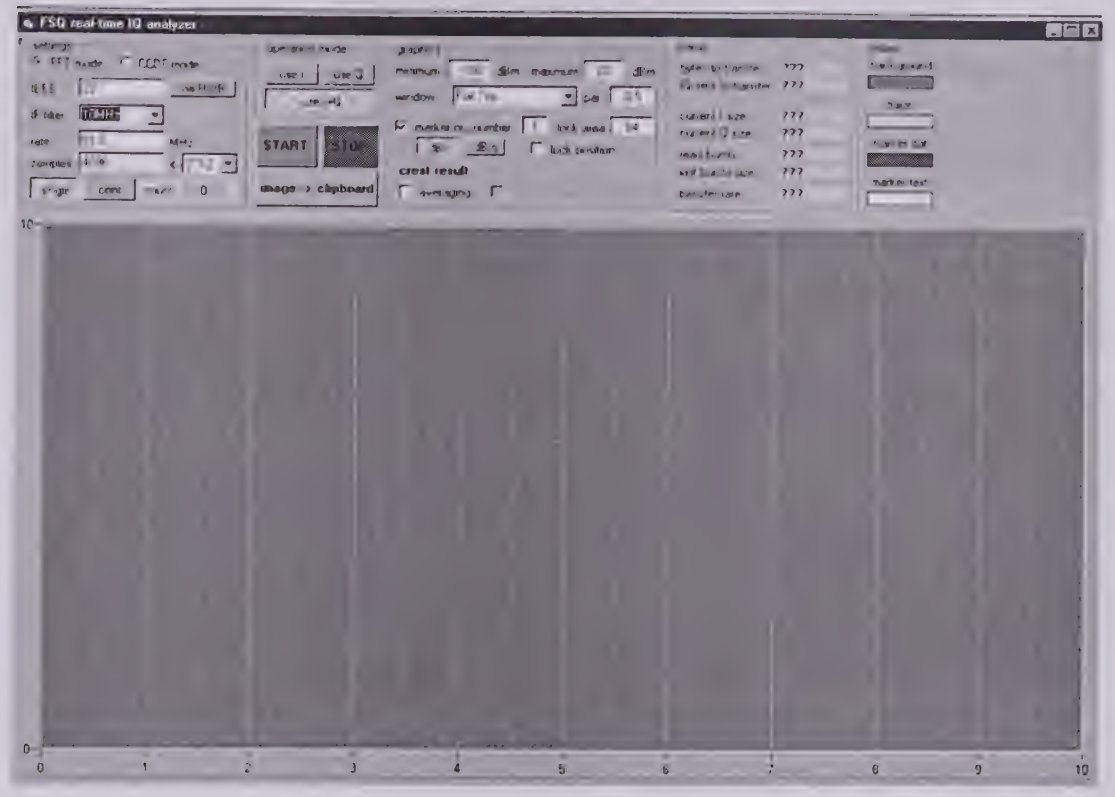
Follow the instructions in "readme.txt" for installing the program.

Two files are created in a directory selected by the user:

ccrptmr6.dll
FSUTest.exe

The program is started by executing *"FSUTest.exe"*.

The program starts with the following default setting. This setting matches the above mentioned command TRACe:IQ: 4096 samples with a sampling rate of 81.6 MHz.



Important tips regarding the program:

1. Level — No complex test signals are used in the performance test, i.e only one test signal is fed into I or Q. Therefore, the complex FFT always supplies two spectral lines at the positive and negative frequency. These two lines have the same level and are smaller than the test signal by 3.01 dB.

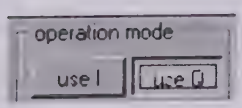
   The marker automatically goes to the largest signal (the n largest signals, with number = n). Add 3.01 dB to the marker value (dBm).

2. Harmonic ratio — Activate several markers; the ratio can be directly read in dBc.

3. I/Q offset — Read out the level at frequency zero (DC). (No 3.01 dB correction with DC.)
   Conversion to voltage (DC): $U / V = \sqrt{ (0.05 * 10^{(0.1 * \text{power/dBm})})}$

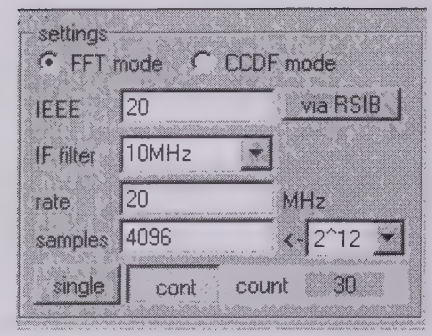
4. Noise — The noise is to be separately tested for each channel; therefore, only I or Q values are to be evaluated.

Press the buttons "use I" or "use Q" depending on the channel to be measured.

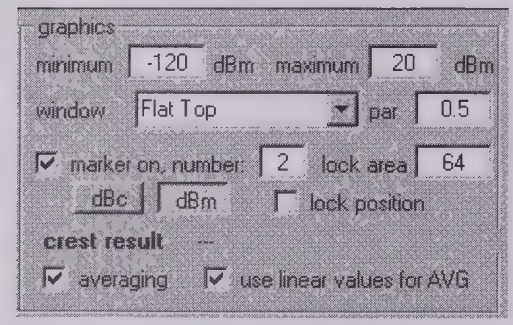


The following setting is recommended:

rate = 20 MHz
samples = 4096
cont(inuous), count = 30



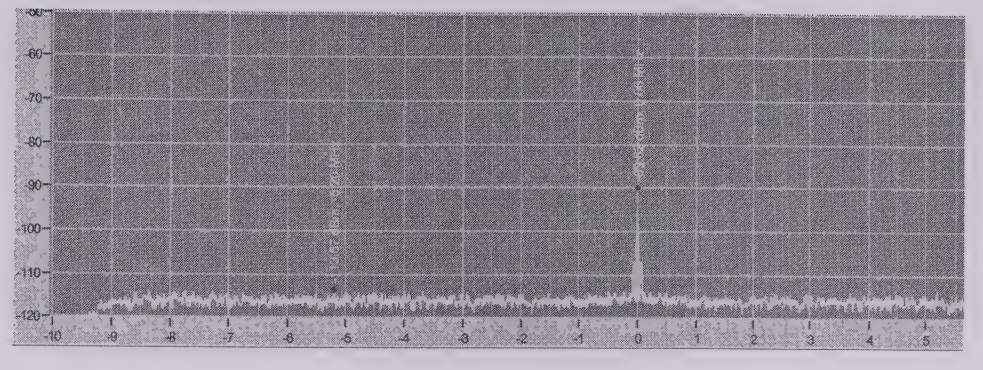
minimum = –120 dBm
window = Flat top
marker on, number = 2, (unit) dBm
averaging
use linear values for AVG



Press the start key to start the measurement.

30 FFTs are averaged. The first marker goes to the DC line, the second one to the maximum value in the noise (in the range 0 ± 10 MHz).

Measurement example:



Conversion to power in 1 Hz bandwidth: value displayed at the marker – 41.1 dB.

In the example: -113.57 dBm – 41.1 dB = -154.67 dBm [1Hz]

The correction value –41,1 dB is only valid for the specified setting.
(30 linear averages, 4096 samples, flattop window, rate 20 MHz)

Conversion to voltage (RMS): $U_{RMS} / V = \sqrt{ (0,05 * 10^{(0.1 * power/dBm)})}$

In the example: -154.67 dBm = $4.13 * 10^{-9}$ = 4.13 nV

Manual operation of the FSQ baseband signal input

For manual measurements using the FFT program described earlier, manual operation of the baseband signal is available after entering the service password.

[**SETUP:** SERVICE: ENTER PASSWORD: 894129: ENTER]

Instrument setting by manual operation is described in the following performance test.
The IEC/IEEE bus commands are provided in the operating manual.

Testing the Level Error (50 Ω)

All test results must be determined from the I/Q data. The sampling rate is 81.6 MHz in each case.

Test equipment:

Signal generator	item 3
Power meter	item 8
Power sensor	item 10
6 dB divider	item 6

Determination of the absolute error at 1 MHz

Test setup:

Set the frequency correction of the power meter to 1 MHz.
Connect the power sensor to the power meter and execute the ZERO function if no signal is applied to the power sensor.
Connect the power sensor to the RF output of the signal generator.

Signal generator settings:

- Frequency 1 MHz

Level peak	dBm
1000 mV	+10 dBm
562 mV	+5 dBm
316 mV	0 dBm
178 mV	-5 dBm
100 mV	-10 dBm
56.2 mV	-15 dBm
31.6 mV	-20 dBm

Measurement:

Determine the signal generator output power at all levels using the power meter.

Test setup:

Connect the RF output of the signal generator to the I-high input of the FSQ.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED ON: FILTER OFF: DITHER OFF]
[**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

- Frequency on generator 1 MHz

Level on generator

peak	dBm	REF LEVEL on FSQ
1000 mV	+10 dBm	5.62 V
1000 mV	+10 dBm	3.16 V
1000 mV	+10 dBm	1.78 V
1000 mV	+10 dBm	1 V
562 mV	+5 dBm	562 mV
316 mV	0 dBm	316 mV
178 mV	-5 dBm	178 mV
100 mV	-10 dBm	100 mV
56.2 mV	-15 dBm	56.2 mV
31.6 mV	-20 dBm	31.6 mV

Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

The difference between the signal levels of the power meter and the FSQ reflects the level error of the FSQ.

Then evaluate the imbalance: The ratio I-high/Q-high as well as I-low/Q-low at all levels.

Determine the level using the FFT.

Testing the frequency response

- without filter

Test setup:

Connect the RF output of the signal generator to the input of the 6 dB divider.
Connect output 1 of the divider to the power meter sensor.
Connect output 2 of the divider to the I-high input of the FSQ.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER OFF: DITHER OFF]
[**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

Level on FSQ	Freq. on generator	REF LEVEL on FSQ
10 dBm	1 MHz	1 V
	2 MHz	
	5 MHz	
	10 MHz	
	20 MHz	
	36 MHz	
5 dBm	1 MHz	562 mV
	20 MHz	
	36 MHz	
0 dBm	1 MHz	316 mV
	20 MHz	
	36 MHz	
-10 dBm	1 MHz	100 mV
	20 MHz	
	36 MHz	

Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Reference frequency = 1 MHz.
The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the FSQ. The frequency correction of the power meter must correspond to the test frequency used.

Then evaluate the imbalance: At all levels calculate the difference of the frequency responses between I-high and Q-high as well as I-low and Q-low.

Determine the level using the FFT.

Testing the frequency response

- with filter

Test setup:

Test setup as above.
Connect output 2 of the divider to the I-high input of the FSQ.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG**:** I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **1 V**]

Measurement sequence:

Level on FSQ	Freq. on generator
10 dBm	1 MHz
	2 MHz
	5 MHz
	10 MHz
	20 MHz
	30 MHz

Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Reference frequency = 1 MHz.
The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the FSQ. The frequency correction of the power meter must correspond to the test frequency used.

Then evaluate the imbalance: Calculate the difference of the frequency responses between I-high and Q-high as well as I-low and Q-low.

Determine the level using the FFT.

Dynamic Range (50 Ω)

Test equipment:

Signal generator	Item 3
6 dB divider	Item 6
Lowpass 15 MHz	Item 13
4 x 50 Ω termination	Item 25

Spurious and harmonics

Test setup:

Connect the signal generator RF output with inserted lowpass to the I-high input of the FSQ. It should be possible to bypass the lowpass .
Measurements at 12 MHz with lowpass.
Measurements at 30 MHz without lowpass.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

Level at FSQ input	Freq. on generator	REF LEVEL on FSQ
10 dBm	12 MHz	1 V
	30 MHz	
0 dBm	12 MHz	316 mV
	30 MHz	
-10 dBm	12 MHz	100 mV
	30 MHz	

Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Use the FFT to determine the level difference (dBc) between the test signal and the next higher spectral line (without DC).
Only evaluate the frequency range >0 to 36 MHz.

All following measurements are to be performed with 50 Ω termination.

Noise floor

Test setup: Terminate all 4 baseband inputs of the FSQ with 50 Ω (item 25). No connection to other instruments such as signal generator. Otherwise, interference signals can be coupled via ground loops, which would corrupt the noise floor measurement.

FSQ settings: [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **562mV**]

Evaluation: Measure the noise floor using the FFT. Measure I and Q separately. Also use the measured I data for the FFT and set all Q values to zero and vice versa.
The noise is almost constant in the entire frequency range up to 30 MHz and can therefore be measured at any frequency.
Averaging is required to obtain stable measurement results. It is possible to average over several FFTs at one frequency (e.g. 10 MHz) or, what is much faster, to average all values in a sufficiently large frequency range (e.g. 9 to 11 MHz) within one FFT.
The result is the average value in volts.
Conversion to the rms value in 1 Hz bandwidth:
Assuming a sampling rate of 81.6 MHz and 4k FFT with flattop window (NBW 3.88 bins), the correction factor is –47.8 dB or $4.06 * 10^{-3}$.

FSQ settings: [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **178mV**]

Evaluation: as before

FSQ settings: [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **31.6mV**]

Evaluation: as before

I/Q offset

Test setup: Equip all 4 baseband inputs of the FSQ with 50 Ω termination (item 25).

FSQ settings: [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 50Ω: BALANCED **see table**: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **see table**]

Measurement sequence:

BALANCED	REF LEVEL on the FSQ
ON	1 V
	562 mV
	316 mV
	178 mV
	100 mV
	56.2 mV
	31.6 mV
OFF	1 V
	562 mV
	316 mV
	178 mV
	100 mV
	56.2 mV
	31.6 mV

Evaluation: Evaluation performed from the FFT at the zero frequency. Directly yields the I/Q offset in volts (= length of the vector for the zero-point error).

Measurements with 1 kΩ Input Impedance

Note: *Since a 50 Ω termination is screwed into the input for all measurements, the input impedance is approximately 50 Ω (precisely 47.62 Ω). Therefore, the same level settings as for the previous measurements with 50 Ω can be used on the signal generator.*

Checking the Level Error (1 kΩ)

All measurement results must be determined from the I/Q data. The sampling rate is 81.6 MHz.

Test equipment:

Signal generator	Item 3
Power meter	Item 8
Power sensor	Item 10
6 dB divider	Item 6
4 x 50 Ω termination	Item 25

Determination of the absolute error at 1 MHz

Note: *The **signal source calibration** is performed as described for the measurement with an input impedance of 50 Ω. Repetition is not necessary. The calibration data previously determined can be used.*

Test setup:

Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (to be directly screwed on).
Connect the RF output of the signal generator to the I-high input of the FSQ.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1 kΩ: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **1 V**]

Measurement:

- Frequency on signal generator 1 MHz
- Level on signal generator 10 dBm

Repeat the measurement after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

The difference between the signal level of the power meter (from previous calibration) and the FSQ reflects the absolute level error of the FSQ. However, mismatch must be taken into account. The FSQ measures, by definition, the voltage at the I/Q input. The source was calibrated with a load of 50 Ω (power sensor). The load for the source is now 50 Ω in parallel with 1 kΩ.
This means that the nominal value displayed by the FSQ is 0.214 dB lower than the value displayed by the power meter during source calibration.

Determine the level by using the FFT.

Also evaluate the imbalance: I-high/Q-high ratio in dB.

Checking the frequency response

Test setup:

Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (to be directly screwed on).

Connect the RF output of the signal generator to the input of the 6 dB divider.
Connect output 1 of the divider to the power meter sensor.
Connect output 2 of the divider to the I-high input of the FSQ.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1 kΩ: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : 1 V]

Measurement sequence:

Level on the FSQ	Freq. on the generator
10 dBm	1 MHz
	5 MHz
	10 MHz

Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation:

Reference frequency = 1 MHz.
The power meter controls the frequency response of the source. Deduct the frequency response from the value displayed on the FSQ. The frequency correction of the power meter must correspond to the test frequency used.

Also evaluate the imbalance: Calculate the difference between I-high and Q-high as well as between I-low and Q-low.

Determine the level using the FFT.

Dynamic Range (1 kΩ)

Test equipment:

Signal generator	Item 3
6 dB divider	Item 6
Lowpass 15 MHz	Item 13
4 x 50 Ω termination	Item 25

Spurious and harmonics

Test setup:

Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (to be directly screwed on).
Connect the signal generator RF output with inserted lowpass to the I-high input of the FSQ. It should be possible to bypass the lowpass.
Measurements at 12 MHz with lowpass.
Measurements at 30 MHz without lowpass.

FSQ settings:

[**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1 kΩ: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : 1 V]

Measurement sequence:

Level on the FSQ input	Freq. on the generator
10 dBm	12 MHz
	30 MHz

Repeat the measurement sequence after connecting the RF output of the signal generator to the I-low, Q-high, Q-low input of the FSQ.

Evaluation: Use the FFT to determine the level difference between the test signal and the next higher spectral line (without DC).
Only evaluate the frequency range >0 to 36 MHz.

Noise floor

Test setup: Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (item 25). No connection to other instruments such as signal generator. Otherwise, interference signals can be coupled via ground loops, which would corrupt the noise floor measurement.

FSQ settings: [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1 kΩ: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **31.6mV**]

Evaluation: Measure the noise floor using the FFT. Measure I and Q separately. Also use the measured I data for the FFT and set all Q values to zero and vice versa.
The noise is almost constant in the entire frequency range up to 30 MHz and can therefore be measured at any frequency.
Averaging is required to obtain stable measurement results. It is possible to average over several FFTs at one frequency (e.g. 10 MHz) or, what is much faster, to average all values in a sufficiently large frequency range (e.g. 9 to 11 MHz) within one FFT.
The result is the average value in volts.
Conversion to the rms value in 1 Hz bandwidth:
Assuming a sampling rate of 81.6 MHz and 4k FFT with flattop window (NBW 3.88 bins), the correction factor is –47.8 dB or $4.06 * 10^{-3}$.

I/Q offset

Test setup: Equip all 4 baseband inputs of the FSQ with a 50 Ω termination (item 25).

FSQ settings: [**SETUP:** SIGNAL SOURCE: BASEBAND ANALOG: I/Q INPUT 1kΩ: BALANCED ON: FILTER ON: DITHER OFF]
[**AMPT** : REF LEVEL : **100mV**]

Evaluation: Evaluation performed from the FFT at the zero frequency. Directly yields the I/Q offset in volts (= length of the vector for the zero-point error).

Performance Test Report FSQ

Table 1-1 Performance Test report

ROHDE & SCHWARZ	Performance Test Report	Spectrum Analyzer FSQ	Version 02-11-13
Model (FSQ 3/ FSQ 8/ FSQ 26):			
Order number:	1155.5001.03 / 1155.5001.08 / 1155.5001.26		
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency accuracy Reference oscillator	Page 1.4					
Model w/o Opt. B4		9.999999	_____	10.000001	MHz	
Model with Opt. B4		9.9999997	_____	10.0000003	MHz	
Image frequency rejection,1st IF, f_{in}	Page 1.5					
11 MHz		90	_____	-	dB	
100 MHz		90	_____	-	dB	
1701 MHz		90	_____	-	dB	
3001 MHz		90	_____	-	dB	
Image frequency rejection 2^{nd} IF, f_{in}	Page 1.5					
100 MHz		90	_____	-	dB	
FSQ 8, FSQ 26:						
3700 MHz		70	_____	-	dB	
5000 MHz		70	_____	-	dB	
7999 MHz		70	_____	-	dB	
FSQ 26:						
26000 MHz		70	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Image frequency rejection 3rd IF, f_{in}	Page 1.5					
100 MHz		90	_____	-	dB	
FSQ 8, FSQ 26:						
4500 MHz		70	_____	-	dB	
FSQ						
2000 MHz			_____	-	dB	
1st IF rejection f_{in}	Page 1.6					
11 MHz		90	_____	-	dB	
100 MHz		90	_____	-	dB	
1701 MHz		90	_____	-	dB	
2990 MHz		90	_____	-	dB	
2^{nd} IF rejection f_{in}	Page 1.6					
FSQ 3, FSQ 8:						
100 MHz		90	_____	-	DB	
FSQ 3, FSQ 8:						
4500 MHz		70	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point, f_{in}	Page 1.7					
FSQ 3, FSQ 8:						
28 MHz		17	_____	-	dBm	
106 MHz		17	_____	-	dBm	
261 MHz		17	_____	-	dBm	
640 MHz		20	_____	-	dBm	
1000 MHz		20	_____	-	dBm	
1700 MHz		20	_____	-	dBm	
2500 MHz		20	_____	-	dBm	
3590 MHz		20	_____	-	dBm	
FSQ 8:						
4001 MHz		19	_____	-	dBm	
5001 MHz		19	_____	-	dBm	
7999 MHz		19	_____	-	dBm	
FSQ 26:		17				
28 MHz		17	_____	-	dBm	
106 MHz		17	_____	-	dBm	
261 MHz		22	_____	-	dBm	
640 MHz		22	_____	-	dBm	
1000 MHz		22	_____	-	dBm	
1700 MHz		22	_____	-	dBm	
2500 MHz		22	_____	-	dBm	
3590 MHz		12	_____	-	dBm	
4001 MHz		12	_____	-	dBm	
5001 MHz		12	_____	-	dBm	
7999 MHz		12	_____	-	dBm	
12000 MHz		12	_____	-	dBm	
20000 MHz		12	_____	-	dBm	
26000 MHz			_____	-	dBm	
2^{nd}-order harmonic distortion, f_{in} :	Page 1.8					
28 MHz		35	_____	-	dBm	
106 MHz		35	_____	-	dBm	
261 MHz		45	_____	-	dBm	
640 MHz		45	_____	-	dBm	
1000 MHz		45	_____	-	dBm	
1700 MHz		35	_____	-	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF bandwidth switch. level accuracy	Page 1.9					
100 Hz		-0.1	_____	+0.1	dB	
1 kHz		-0.1	_____	+0.1	dB	
10 kHz		-	reference	-		
100 kHz		-0.1	_____	+0.1	dB	
300 kHz		-0.2	_____	+0.2	dB	
1 MHz		-0.2	_____	+0.2	dB	
3 MHz		-0.2	_____	+0.2	dB	
10 MHz		-0.2	_____	+0.2	dB	
20 MHz		-0.5	_____	+0.5	dB	
FFT Bandwidth level accuracy	Page 1.9					
100 Hz		-0.2	_____	+0.2	dB	
300 Hz		-0.2	_____	+0.2	dB	
1 kHz		-0.2	_____	+0.2	dB	
3 kHz		-0.2	_____	+0.2	dB	
IF bandwidth Bandwidth:	Page 1.10					
100 Hz		97	_____	103	Hz	
1 kHz		970	_____	1030	Hz	
10 kHz		9.7	_____	10.3	kHz	
100 kHz		97	_____	103	kHz	
300 kHz		270	_____	330	kHz	
1 MHz		900	_____	1100	kHz	
3 MHz		2.7	_____	3.3	MHz	
10 MHz		7	_____	11	MHz	
20 MHz		14	_____	22	MHz	
50 MHz		35	_____	55	MHz	
IF Bandwidths Shape factor:	Page 1.10					
100 Hz		-	_____	6	-	
1 kHz		-	_____	6	-	
10 kHz		-	_____	6	-	
100 kHz		-	_____	6	-	
300 kHz		-	_____	12	-	
1 MHz		-	_____	12	-	
3 MHz		-	_____	7	-	
10 MHz		-	_____	7	-	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display f_{noise}:	Page 1.11					
20 Hz		-	_____	-80	dBm	
90 Hz		-	_____	-100	dBm	
900 Hz		-	_____	-110	dBm	
Noise Display normalized to 10Hz: **FSQ 3 / 8:**	Page 1.11					
9 kHz		-	_____	-125	dBm	
95 kHz		-	_____	-132	dBm	
999 kHz		-	_____	-142	dBm	
9.99 MHz		-	_____	-145	dBm	
19.99 MHz		-	_____	-145	dBm	
49.99 MHz		-	_____	-145	dBm	
99.99 MHz		-	_____	-145	dBm	
199.9 MHz		-	_____	-145	dBm	
499.9 MHz		-	_____	-145	dBm	
999.9 MHz		-	_____	-145	dBm	
1499 MHz		-	_____	-145	dBm	
1999 MHz		-	_____	-145	dBm	
2499 MHz		-	_____	-143	dBm	
2999 MHz		-	_____	-143	dBm	
3599 MHz		-	_____	-142	dBm	
Noise Display normalized to 10Hz: **FSQ 8:**	Page 1.11					
3999 MHz		-	_____	- 140	dBm	
4499 MHz		-	_____	- 140	dBm	
4999 MHz		-	_____	- 140	dBm	
5499 MHz		-	_____	- 140	dBm	
5999 MHz		-	_____	- 140	dBm	
6499 MHz		-	_____	- 140	dBm	
6999 MHz		-	_____	- 140	dBm	
7499 MHz		-	_____	- 139	dBm	
7999 MHz		-	_____	- 139	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 10 Hz: **FSQ 26:**	Page 1.11					
9 kHz		-	_____	-125	dBm	
95 kHz		-	_____	-132	dBm	
999 kHz		-	_____	-142	dBm	
9.99 MHz		-	_____	-142	dBm	
19.99 MHz		-	_____	-142	dBm	
49.99 MHz		-	_____	-142	dBm	
99.99 MHz		-	_____	-142	dBm	
199.9 MHz		-	_____	-142	dBm	
499.9 MHz		-	_____	-142	dBm	
999.9 MHz		-	_____	-142	dBm	
1499 MHz		-	_____	-142	dBm	
1999 MHz		-	_____	-142	dBm	
2499 MHz		-	_____	-140	dBm	
2999 MHz		-	_____	-140	dBm	
3599 MHz			_____	-140	dBm	
3601 MHz		-	_____	-141	dBm	
6999 MHz		-	_____	-141	dBm	
9999 MHz		-	_____	-139	dBm	
12999 MHz		-	_____	-140	dBm	
17999 MHz		-	_____	-137	dBm	
21999 MHz		-	_____	-135	dBm	
26499 MHz		-	_____	-133	dBm	
Level accuracy at 128 MHz. –30 dBm	Page 1.12	-0.2	_____	+0.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF Attenuation 10 dB DC coupling	Page 1.12					
f_{fresp}						
1 MHz		-0.5	_____	+0.5	dB	
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
300 MHz		-0.3	_____	+0.3	dB	
400 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
600 MHz		-0.3	_____	+0.3	dB	
700 MHz		-0.3	_____	+0.3	dB	
800 MHz		-0.3	_____	+0.3	dB	
900 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB DC coupling	Page 1.12					
FSQ 8, FSQ 26: f_{fresp}						
3610 MHz		-1.5	_____	+1.5	dB	
4000 MHz		-1.5	_____	+1.5	dB	
4500 MHz		-1.5	_____	+1.5	dB	
5000 MHz		-1.5	_____	+1.5	dB	
5500 MHz		-1.5	_____	+1.5	dB	
6000 MHz		-1.5	_____	+1.5	dB	
6500 MHz		-1.5	_____	+1.5	dB	
7000 MHz		-1.5	_____	+1.5	dB	
7990 MHz		-2	_____	+2	dB	
FSQ 26:						
9000 MHz		-2	_____	+2	dB	
10000 MHz		-2	_____	+2	dB	
11000 MHz		-2	_____	+2	dB	
12000 MHz		-2	_____	+2	dB	
13000 MHz		-2	_____	+2	dB	
14000 MHz		-2	_____	+2	dB	
15000 MHz		-2	_____	+2	dB	
16000 MHz		-2	_____	+2	dB	
17000 MHz		-2	_____	+2	dB	
18000 MHz		-2	_____	+2	dB	
19000 MHz		-2	_____	+2	dB	
20000 MHz		-2	_____	+2	dB	
21000 MHz		-2	_____	+2	dB	
22000 MHz		-2	_____	+2	dB	
23000 MHz		-2.5	_____	+2.5	dB	
24000 MHz		-2.5	_____	+2.5	dB	
25000 MHz		-2.5	_____	+2.5	dB	
26000 MHz		-2.5	_____	+2.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB AC coupling f_{fresp}	Page 1.12					
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	
Frequency response RF attenuation 5 dB DC coupling f_{fresp}	Page 1.12					
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 20 dB DC coupling	Page 1.12					
f_{fresp}						
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	
Frequency response RF attenuation 40 dB DC coupling	Page 1.12					
f_{fresp}						
10 MHz		-0.3	_____	+0.3	dB	
50 MHz		-0.3	_____	+0.3	dB	
100 MHz		-0.3	_____	+0.3	dB	
200 MHz		-0.3	_____	+0.3	dB	
500 MHz		-0.3	_____	+0.3	dB	
1000 MHz		-0.3	_____	+0.3	dB	
1500 MHz		-0.3	_____	+0.3	dB	
2000 MHz		-0.3	_____	+0.3	dB	
2500 MHz		-0.3	_____	+0.3	dB	
3000 MHz		-0.3	_____	+0.3	dB	
3599 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 500 Hz a_{ATT} :	Page 1.15					
10 dB		9.9	_____	10.1	dB	
15 dB		4.9	_____	5.1	dB	
20 dB		-	reference	-	-	
25 dB		-5.1	_____	-4.9	dB	
30 dB		- 10.1	_____	-9.9	dB	
35 dB		-15.1	_____	-14.9	dB	
40 dB		-20.1	_____	-19.9	dB	
45 dB		-25.1	_____	-24.9	dB	
50 dB		-30.1	_____	-29.9	dB	
55 dB		-35.1	_____	-34.9	dB	
60 dB		-40.1	_____	-39.9	dB	
65 dB		-45.1	_____	-44.9	dB	
70 dB		-50.1	_____	-49.9	dB	
75 dB		-55.1	_____	-54.9	dB	
80 dB		-60.1	_____	-59.9	dB	
85 dB		-65.3	_____	-64.7	dB	
90 dB		-70.3	_____	-69.7	dB	
95 dB		-75.3	_____	-74.7	dB	
100 dB		-80.3	_____	-79.7	dB	
Display linearity RBW 300 kHz a_{ATT} :	Page 1.15					
10 dB		9.8	_____	10.2	dB	
15 dB		4.8	_____	5.2	dB	
20 dB		-	reference	-	-	
25 dB		-5.2	_____	-4.8	dB	
30 dB		- 10.2	_____	-9.8	dB	
35 dB		-15.2	_____	-14.8	dB	
40 dB		-20.2	_____	-19.8	dB	
45 dB		-25.2	_____	-24.8	dB	
50 dB		-30.2	_____	-29.8	dB	
55 dB		-35.2	_____	-34.8	dB	
60 dB		-40.2	_____	-39.8	dB	
65 dB		-45.5	_____	-44.5	dB	
70 dB		-50.5	_____	-49.5	dB	
75 dB		-55.5	_____	-54.5	dB	
80 dB		-60.5	_____	-59.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 20 MHz a_{ATT} :	Page 1.15					
10 dB		9.5	_____	10.5	dB	
15 dB		4.5	_____	5.5	dB	
20 dB		-	reference	-	-	
25 dB		-5.5	_____	-4.5	dB	
30 dB		– 10.5	_____	-9.5	dB	
35 dB		-15.5	_____	-14.5	dB	
40 dB		-20.5	_____	-19.5	dB	
45 dB		-25.5	_____	-24.5	dB	
50 dB		-30.5	_____	-29.5	dB	
55 dB		-35.5	_____	-34.5	dB	
60 dB		-40.5	_____	-39.5	dB	
65 dB		-45.5	_____	-44.5	dB	
70 dB		-50.5	_____	-49.5	dB	
Attenuator accuracy a_{ATT} :	Page 1.16					
0 dB		-9.8	_____	-10.2	dB	
5 dB		-4.8	_____	-5.2	dB	
10 dB		-	reference	-	-	
20 dB		+9.8	_____	+10.2	dB	
40 dB		+29.8	_____	+30.2	dB	
Reference level switching accuracy Reference level	Page 1.17					
0 dBm		+9,85	_____	+10,15	dB	
-10 dBm		-	reference	-	-	
-20 dBm		-10.15	_____	-9,85	dB	
-30 dBm		-20.15	_____	-19,85	dB	
-40 dBm		-30.15	_____	-29,85	dB	
-50 dBm		-40.15	_____	-39,85	dB	
-11 dBm		-1.15	_____	-0,85	dB	
-12 dBm		-2.15	_____	-1,85	dB	
-13 dBm		-3.15	_____	-2,85	dB	
-14 dBm		-4.15	_____	-3,85	dB	
-15 dBm		-5.15	_____	-4,85	dB	
-16 dBm		-6.15	_____	-5,85	dB	
-17 dBm		-7.15	_____	-6,85	dB	
-18 dBm		-8.15	_____	-7,85	dB	
-19 dBm		-9.15	_____	-8,85	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Phase noise	Page 1.19					
Offset frequency:						
100 Hz		-	_____	-90	dBc (1Hz)	
1 kHz		-	_____	-112	dBc (1Hz)	
10 kHz		-	_____	-120	dBc (1Hz)	
100 kHz		-	_____	-120	dBc (1Hz)	
1 MHz		-	_____	-138	dBc (1Hz)	
Return Loss	Page 1.21					
RF input						
RF att 10 dB / DC						
f_{in}						
FSQ 3, FSQ 8:						
10 MHz		14	_____	-	dB	
250 MHz		14	_____	-	dB	
500 MHz		14	_____	-	dB	
750 MHz		14	_____	-	dB	
1000 MHz		14	_____	-	dB	
1250 MHz		14	_____	-	dB	
1500 MHz		14	_____	-	dB	
1750 MHz		14	_____	-	dB	
2000 MHz		14	_____	-	dB	
2250 MHz		14	_____	-	dB	
2500 MHz		14	_____	-	dB	
2750 MHz		14	_____	-	dB	
3000 MHz		14	_____	-	dB	
3250 MHz		14	_____	-	dB	
3500 MHz		14	_____	-	dB	
FSQ 8:						
3750 MHz		9,5	_____	-	dB	
4000 MHz		9,5	_____	-	dB	
4250 MHz		9,5	_____	-	dB	
4500 MHz		9,5	_____	-	dB	
4750 MHz		9,5	_____	-	dB	
5000 MHz		9,5	_____	-	dB	
5500 MHz		9,5	_____	-	dB	
6000 MHz		9,5	_____	-	dB	
6500 MHz		9,5	_____	-	dB	
7000 MHz		9,5	_____	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
FSQ 26:						
10 MHz		20	_____	-	dB	
250 MHz		20	_____	-	dB	
500 MHz		20	_____	-	dB	
750 MHz		20	_____	-	dB	
1000 MHz		20	_____	-	dB	
1250 MHz		20	_____	-	dB	
1500 MHz		20	_____	-	dB	
1750 MHz		20	_____	-	dB	
2000 MHz		20	_____	-	dB	
2250 MHz		20	_____	-	dB	
2500 MHz		20	_____	-	dB	
2750 MHz		20	_____	-	dB	
3000 MHz		20	_____	-	dB	
3250 MHz		20	_____	-	dB	
3500 MHz		20	_____	-	dB	
4000 MHz		14	_____	-	dB	
6000 MHz		14	_____	-	dB	
8000 MHz		14	_____	-	dB	
10000 MHz		14	_____	-	dB	
12000 MHz		14	_____	-	dB	
14000 MHz		14	_____	-	dB	
16000 MHz		14	_____	-	dB	
18000 MHz		9,5	_____	-	dB	
20000 MHz		9,5	_____	-	dB	
22000 MHz		9,5	_____	-	dB	
24000 MHz		9,5	_____	-	dB	
26000 MHz		9,5	_____	-	dB	
Frequency response IQ-path f_{fresp}	Page 1.23					
120 MHz		-0.2	_____	+0.2	dB	
136 MHz		-0.2	_____	+0.2	dB	

Performance Test Report Option FSU-B9

Table 1-2: Performance Test Report Option B9, B12

ROHDE & SCHWARZ	Performance Test Report	Option B9	Version 13.11.02
Serial number:			
Option B12 installed: yes / no			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy of the output level at 128 MHz:	Page 1.25					
Without option B12						
0 dBm		- 1	_____	+ 1	dBm	
- 5 dBm		- 6	_____	- 4	dBm	
-10 dBm		- 11	_____	- 9	dBm	
-15 dBm		- 16	_____	- 14	dBm	
-20 dBm		– 21	_____	- 19	dBm	
With option B12						
0 dBm		– 1	_____	+ 1	dBm	
-10 dBm		– 11	_____	– 9	dBm	
-20 dBm		– 21	_____	– 19	dBm	
-40 dBm		– 41	_____	– 39	dBm	
Frequency response Tracking generator 100 kHz to 3.6 GHz output level, referenced to 128 MHz:	Page 1.25					
Without option B12						
0 dBm		- 3	_____	+ 3	dB	
- 5 dBm		– 3	_____	+ 3	dB	
– 10 dBm		– 3	_____	+ 3	dB	
– 15 dBm		– 3	_____	+ 3	dB	
– 20 dBm		– 3	_____	+ 3	dB	
With option B12						
0 dBm		- 4	_____	+ 4	dB	
-10 dBm		– 4	_____	+ 4	dB	
-20 dBm		– 4	_____	+ 4	dB	
-40 dBm		– 4	_____	+ 4	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Dynamic range Tracking generator at 128 MHz: reference level isolation	Page 1.28	 - 1 -	 _____ _____	 + 1 - 100	 dBm dBc	
Checking modulation Tracking generator I/Q modulation +90 ° output level: Signal 1001 MHz residual carrier sideband 999 MHz I/Q modulation -90 ° output level: Signal 999 MHz residual carrier sideband 1001 MHz	Page 1.27	 - 3 - - - 3 - -	 _____ _____ _____ _____ _____ _____	 + 3 - 30 - 30 + 3 - 30 - 30	 dBm dBc dBc dBm dBc dBc	
Checking Modulation Tracking generator AM modulation Carrier level Sgnl spacing 1001 MHz Signal spacing 999 MHz	Page 1.27	 - 3 - 8 - 8	 _____ _____ _____	 + 3 - 4 - 4	 dBm dBc dBc	
Checking modulation Tracking generator FM modulation Carrier level Sgnl spcng 1000.1 MHz Sgnl spcng 999.9 MHz	Page 1.28	 - 5 - 5 - 5	 _____ _____ _____	 + 1 - 3 - 3	 dBm dBc dBc	

Performance Test Report Option B25

Table 1-3: Performance Test Report Option B25

ROHDE & SCHWARZ	Performance Test Report	Option B25	Version 02-11-13
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display with Preamplifier (B25) **FSQ 3 / 8 / 26**: f_{noise}:	Page 1.29					
10.99 MHz		-	_____	-152	dBm	
19.99 MHz		-	_____	-152	dBm	
49.99 MHz		-	_____	-152	dBm	
99.99 MHz		-	_____	-152	dBm	
199.9 MHz		-	_____	-152	dBm	
499.9 MHz		-	_____	-152	dBm	
999.9 MHz		-	_____	-152	dBm	
1499 MHz		-	_____	-152	dBm	
1999 MHz		-	_____	-152	dBm	
2499 MHz		-	_____	-150	dBm	
2999 MHz		-	_____	-150	dBm	
3599 MHz		-	_____	-150	dBm	
Noise Display with Preamplifier (B25) **FSQ 8:** f_{noise}	Page 1.29					
3601 MHz		-	_____	-147	dBm	
3999 MHz		-	_____	-147	dBm	
4499 MHz		-	_____	-147	dBm	
4999 MHz		-	_____	-147	dBm	
5499 MHz		-	_____	-147	dBm	
5999 MHz		-	_____	-147	dBm	
6499 MHz		-	_____	-147	dBm	
6999 MHz		-	_____	-147	dBm	
7999 MHz		-	_____	-147	dBm	
Level accuracy with Preamplifier (B25) at 128 MHz, -30 dBm	Page 1.30	-0.3	_____	+0.3	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with preamplifier (B25) **FSQ 3 / 8 / 26 :** f_{fresp}	Page 1.30					
10 MHz		-1	_____	+1	dB	
50 MHz		-0.6	_____	+0.6	dB	
100 MHz		-0.6	_____	+0.6	dB	
200 MHz		-0.6	_____	+0.6	dB	
300 MHz		-0.6	_____	+0.6	dB	
400 MHz		-0.6	_____	+0.6	dB	
500 MHz		-0.6	_____	+0.6	dB	
600 MHz		-0.6	_____	+0.6	dB	
700 MHz		-0.6	_____	+0.6	dB	
800 MHz		-0.6	_____	+0.6	dB	
900 MHz		-0.6	_____	+0.6	dB	
1000 MHz		-0.6	_____	+0.6	dB	
1500 MHz		-0.6	_____	+0.6	dB	
2000 MHz		-0.6	_____	+0.6	dB	
2500 MHz		-0.6	_____	+0.6	dB	
2990 MHz		-0.6	_____	+0.6	dB	
3590 MHz		-0.6	_____	+0.6	dB	
Frequency Response with preamplifier (B25) **FSQ 8:** f_{fresp}	Page 1.30					
3610 MHz		-2	_____	+2	dB	
4000 MHz		-2	_____	+2	dB	
4500 MHz		-2	_____	+2	dB	
5000 MHz		-2	_____	+2	dB	
5500 MHz		-2	_____	+2	dB	
6000 MHz		-2	_____	+2	dB	
6500 MHz		-2	_____	+2	dB	
6990 MHz		-2	_____	+2	dB	
7990 MHz		-2	_____	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25) E_{ATT} = 5 dB f_{fresp}	Page 1.33					
10 MHz		-1	_____	+1	dB	
50 MHz		-0.6	_____	+0.6	dB	
100 MHz		-0.6	_____	+0.6	dB	
200 MHz		-0.6	_____	+0.6	dB	
300 MHz		-0.6	_____	+0.6	dB	
400 MHz		-0.6	_____	+0.6	dB	
500 MHz		-0.6	_____	+0.6	dB	
600 MHz		-0.6	_____	+0.6	dB	
700 MHz		-0.6	_____	+0.6	dB	
800 MHz		-0.6	_____	+0.6	dB	
900 MHz		-0.6	_____	+0.6	dB	
1000 MHz		-0.6	_____	+0.6	dB	
1500 MHz		-0.6	_____	+0.6	dB	
2000 MHz		-0.6	_____	+0.6	dB	
2500 MHz		-0.6	_____	+0.6	dB	
2990 MHz		-0.6	_____	+0.6	dB	
3590 MHz		-0.6	_____	+0.6	dB	
Frequency Response elec. attenuator (B25) E_{ATT} = 5 dB **FSQ 8:** f_{fresp}	Page 1.33					
3610 MHz		-2	_____	+2	dB	
4000 MHz		-2	_____	+2	dB	
4500 MHz		-2	_____	+2	dB	
5000 MHz		-2	_____	+2	dB	
5500 MHz		-2	_____	+2	dB	
6000 MHz		-2	_____	+2	dB	
6500 MHz		-2	_____	+2	dB	
6990 MHz		-2	_____	+2	dB	
7990 MHz		-2	_____	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.33					
E_{ATT} = 10 dB						
f_{fresp}						
10 MHz		-1	_____	+1	dB	
50 MHz		-0.6	_____	+0.6	dB	
100 MHz		-0.6	_____	+0.6	dB	
200 MHz		-0.6	_____	+0.6	dB	
300 MHz		-0.6	_____	+0.6	dB	
400 MHz		-0.6	_____	+0.6	dB	
500 MHz		-0.6	_____	+0.6	dB	
600 MHz		-0.6	_____	+0.6	dB	
700 MHz		-0.6	_____	+0.6	dB	
800 MHz		-0.6	_____	+0.6	dB	
900 MHz		-0.6	_____	+0.6	dB	
1000 MHz		-0.6	_____	+0.6	dB	
1500 MHz		-0.6	_____	+0.6	dB	
2000 MHz		-0.6	_____	+0.6	dB	
2500 MHz		-0.6	_____	+0.6	dB	
2990 MHz		-0.6	_____	+0.6	dB	
3590 MHz		-0.6	_____	+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.33					
E_{ATT} = 10 dB						
FSQ 8: f_{fresp}						
3610 MHz		-2	_____	+2	dB	
4000 MHz		-2	_____	+2	dB	
4500 MHz		-2	_____	+2	dB	
5000 MHz		-2	_____	+2	dB	
5500 MHz		-2	_____	+2	dB	
6000 MHz		-2	_____	+2	dB	
6500 MHz		-2	_____	+2	dB	
6990 MHz		-2	_____	+2	dB	
7990 MHz		-2	_____	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25) E_{ATT} = 15 dB f_{fresp}	Page 1.33					
10 MHz		-1	_____	+1	dB	
50 MHz		-0.6	_____	+0.6	dB	
100 MHz		-0.6	_____	+0.6	dB	
200 MHz		-0.6	_____	+0.6	dB	
300 MHz		-0.6	_____	+0.6	dB	
400 MHz		-0.6	_____	+0.6	dB	
500 MHz		-0.6	_____	+0.6	dB	
600 MHz		-0.6	_____	+0.6	dB	
700 MHz		-0.6	_____	+0.6	dB	
800 MHz		-0.6	_____	+0.6	dB	
900 MHz		-0.6	_____	+0.6	dB	
1000 MHz		-0.6	_____	+0.6	dB	
1500 MHz		-0.6	_____	+0.6	dB	
2000 MHz		-0.6	_____	+0.6	dB	
2500 MHz		-0.6	_____	+0.6	dB	
2990 MHz		-0.6	_____	+0.6	dB	
3590 MHz		-0.6	_____	+0.6	dB	
Frequency Response elec. attenuator (B25) E_{ATT} = 15 dB **FSQ 8:** f_{fresp}	Page 1.33					
3610 MHz		-2	_____	+2	dB	
4000 MHz		-2	_____	+2	dB	
4500 MHz		-2	_____	+2	dB	
5000 MHz		-2	_____	+2	dB	
5500 MHz		-2	_____	+2	dB	
6000 MHz		-2	_____	+2	dB	
6500 MHz		-2	_____	+2	dB	
6990 MHz		-2	_____	+2	dB	
7990 MHz		-2	_____	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point with elec. att., f_{in}	Page 1.35					
28 MHz		17	_____	-	dBm	
106 MHz		17	_____	-	dBm	
261 MHz		17	_____	-	dBm	
640 MHz		20	_____	-	dBm	
1000 MHz		20	_____	-	dBm	
1700 MHz		20	_____	-	dBm	
2500 MHz		20	_____	-	dBm	
3590 MHz		20	_____	-	dBm	
FSQ 8:						
3610 MHz		18	_____	-	dBm	
5000 MHz		18	_____	-	dBm	
7990 MHz		18	_____	-	dBm	
Attenuator accuracy, a_{ATT} :	Page 1.36					
0 dB		-9.8	_____	-10.2	dB	
5 dB		-4.8	_____	-5.2	dB	
10 dB		-	reference	-	-	
15 dB		+4.8	_____	+5.2	dB	
20 dB		+9.8	_____	+10.2	dB	
25 dB		+14.8	_____	+15.2	dB	
30 dB		+19.8	_____	+20.2	dB	
35 dB		+24.8	_____	+25.2	dB	
40 dB		+29.8	_____	+30.2	dB	
45 dB		+34.8	_____	+35.2	dB	
50 dB		+39.8	_____	+40.2	dB	
55 dB		+44.8	_____	+45.2	dB	
60 dB		+49.8	_____	+50.2	dB	
65 dB		+54.8	_____	+55.2	dB	
70 dB		+59.8	_____	+60.2	dB	
75 dB		+64.8	_____	+65.2	dB	
Electronic Attenuator accuracy ., a_{ATT}	Page 1.37					
0 dB		-0.2	_____	+0.2	dB	
5 dB		+4.8	_____	+5.2	dB	
10 dB		+9.8	_____	+10.2	dB	
15 dB		+14.8	_____	+15.2	dB	
20 dB		+19.8	_____	+20.2	dB	
25 dB		+24.8	_____	+25.2	dB	
30 dB		+29.8	_____	+30.2	dB	

Performance Test Report Option FSQ-B71

Table 1-4: Performance Test Report Option FSQ-B71

ROHDE & SCHWARZ	Performance Test Report	Option FSQ-B71	Version 02-11-14
Serial number:			
Test person:			
Date:			
Signature:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level error						
Absolute error at 1 MHz, 50 Ω	Page 1.42					
Input I-high						
RefLevel						
5.62 V		-0.25	_____	+0.25	dB	
3.16 V		-0.25	_____	+0.25	dB	
1.78 V		-0.25	_____	+0.25	dB	
1 V		-0.25	_____	+0.25	dB	
562 mV		-0.25	_____	+0.25	dB	
316 mV		-0.25	_____	+0.25	dB	
178 mV		-0.25	_____	+0.25	dB	
100 mV		-0.25	_____	+0.25	dB	
56.2 mV		-0.25	_____	+0.25	dB	
31.6 mV		-0.25	_____	+0.25	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input I-low						
RefLevel						
5.62 V		-0.25	_____	+0.25	dB	
3.16 V		-0.25	_____	+0.25	dB	
1.78 V		-0.25	_____	+0.25	dB	
1 V		-0.25	_____	+0.25	dB	
562 mV		-0.25	_____	+0.25	dB	
316 mV		-0.25	_____	+0.25	dB	
178 mV		-0.25	_____	+0.25	dB	
100 mV		-0.25	_____	+0.25	dB	
56.2 mV		-0.25	_____	+0.25	dB	
31.6 mV		-0.25	_____	+0.25	dB	
Input Q-high						
RefLevel						
5.62 V		-0.25	_____	+0.25	dB	
3.16 V		-0.25	_____	+0.25	dB	
1.78 V		-0.25	_____	+0.25	dB	
1 V		-0.25	_____	+0.25	dB	
562 mV		-0.25	_____	+0.25	dB	
316 mV		-0.25	_____	+0.25	dB	
178 mV		-0.25	_____	+0.25	dB	
100 mV		-0.25	_____	+0.25	dB	
56.2 mV		-0.25	_____	+0.25	dB	
31.6 mV		-0.25	_____	+0.25	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input Q-low						
RefLevel						
5.62 V		-0.25	_____	+0.25	dB	
3.16 V		-0.25	_____	+0.25	dB	
1.78 V		-0.25	_____	+0.25	dB	
1 V		-0.25	_____	+0.25	dB	
562 mV		-0.25	_____	+0.25	dB	
316 mV		-0.25	_____	+0.25	dB	
178 mV		-0.25	_____	+0.25	dB	
100 mV		-0.25	_____	+0.25	dB	
56.2 mV		-0.25	_____	+0.25	dB	
31.6 mV		-0.25	_____	+0.25	dB	
I/Q imbalance at 1 MHz, 50 Ω	Page 1.42					
I-high – Q-high						
RefLevel						
5.62 V		-0.1	_____	+0.1	dB	
3.16 V		-0.1	_____	+0.1	dB	
1.78 V		-0.1	_____	+0.1	dB	
1 V		-0.1	_____	+0.1	dB	
562 mV		-0.1	_____	+0.1	dB	
316 mV		-0.1	_____	+0.1	dB	
178 mV		-0.1	_____	+0.1	dB	
100 mV		-0.1	_____	+0.1	dB	
56.2 mV		-0.1	_____	+0.1	dB	
31.6 mV		-0.1	_____	+0.1	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I-low – Q-low						
RefLevel						
5.62 V		-0.1	_____	+0.1	dB	
3.16 V		-0.1	_____	+0.1	dB	
1.78 V		-0.1	_____	+0.1	dB	
1 V		-0.1	_____	+0.1	dB	
562 mV		-0.1	_____	+0.1	dB	
316 mV		-0.1	_____	+0.1	dB	
178 mV		-0.1	_____	+0.1	dB	
100 mV		-0.1	_____	+0.1	dB	
56.2 mV		-0.1	_____	+0.1	dB	
31.6 mV		-0.1	_____	+0.1	dB	
Frequency response, reference 1 MHz, without filter, 50 Ω	Page 1.42					
Input I-high						
RefLevel 1 V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input I-low						
RefLevel 1 V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
Input Q-high						
RefLevel 1 V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input Q-low						
RefLevel 1V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 562 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 316 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	
RefLevel 100 mV						
20 MHz		-0.3	_____	+0.3	dB	
36 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q Imbalance, Frequency response without filter, 50Ω	Page 1.42					
I-high – Q-high						
RefLevel 1 V						
2 MHz		-0.15	_____	+0.15	dB	
5 MHz		-0.15	_____	+0.15	dB	
10 MHz		-0.15	_____	+0.15	dB	
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
RefLevel 562 mV						
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
RefLevel 316 mV						
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
RefLevel 100 mV						
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I-low – Q-low						
RefLevel 1 V						
2 MHz		-0.15	_____	+0.15	dB	
5 MHz		-0.15	_____	+0.15	dB	
10 MHz		-0.15	_____	+0.15	dB	
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
RefLevel 562 mV						
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
RefLevel 316 mV						
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
RefLevel 100 mV						
20 MHz		-0.15	_____	+0.15	dB	
36 MHz		-0.15	_____	+0.15	dB	
Frequency response, Reference 1 MHz, with filter, 50 Ω	Page 1.43					
Input I-high						
RefLevel 1 V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
30 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input I-low						
RefLevel 1 V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
30 MHz		-0.3	_____	+0.3	dB	
Input Q-high						
RefLevel 1 V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
30 MHz		-0.3	_____	+0.3	dB	
Input Q-low						
RefLevel 1V						
2 MHz		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz		-0.3	_____	+0.3	dB	
20 MHz		-0.3	_____	+0.3	dB	
30 MHz		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q Imbalance, Frequency response with filter, 50Ω	Page 1.43					
I-high – Q-high						
RefLevel 1 V						
2 MHz		-0.15	_____	+0.15	dB	
5 MHz		-0.15	_____	+0.15	dB	
10 MHz		-0.15	_____	+0.15	dB	
20 MHz		-0.15	_____	+0.15	dB	
30 MHz		-0.15	_____	+0.15	dB	
I-low – Q-low						
RefLevel 1 V						
2 MHz		-0.15	_____	+0.15	dB	
5 MHz		-0.15	_____	+0.15	dB	
10 MHz		-0.15	_____	+0.15	dB	
20 MHz		-0.15	_____	+0.15	dB	
30 MHz		-0.15	_____	+0.15	dB	
Spurious & Harmonics, 50 Ω	Page 1.44					
Input I-high						
RefLevel 1 V						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 316 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 100 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Input I-low						
RefLevel 1 V						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 316 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 100 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
Input Q-high						
RefLevel 1 V						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 316 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 100 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
Input Q-low						
RefLevel 1 V						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 316 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	
RefLevel 100 mV						
12 MHz		54	_____		dBc	
30 MHz		54	_____		dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise floor, 50 Ω, balanced	Page 1.45					
Noise voltage in 1 Hz bandwidth						
Channel Q						
RefLevel 562 mV			_____	70	nV	
RefLevel 178 mV			_____	35	nV	
RefLevel 31.6 mV			_____	10	nV	
Channel I						
RefLevel 562 mV			_____	70	nV	
RefLevel 178 mV			_____	35	nV	
RefLevel 31.6 mV			_____	10	nV	
I/Q offset, 50 Ω	Page 1.45					
Balanced						
RefLevel						
1 V		-1.7	_____	1.7	mV	
562 mV		-1.04	_____	1.04	mV	
316 mV		-0.67	_____	0.67	mV	
178 mV		-0.47	_____	0.47	mV	
100 mV		-0.35	_____	0.35	mV	
56.2 mV		-0.28	_____	0.28	mV	
31.6 mV		-0.25	_____	0.25	mV	
Unbalanced						
RefLevel						
1 V		-2	_____	2	mV	
562 mV		-2	_____	2	mV	
316 mV		-2	_____	2	mV	
178 mV		-2	_____	2	mV	
100 mV		-2	_____	2	mV	
56.2 mV		-2	_____	2	mV	
31.6 mV		-2	_____	2	mV	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level error						
Absolute error at 1 MHz, 1 kΩ RefLevel 1 V	Page 1.46					
Input I-high		-0.25	_____	+0.25	dB	
Input I-low		-0.25	_____	+0.25	dB	
Input Q-high		-0.25	_____	+0.25	dB	
Input Q-low		-0.25	_____	+0.25	dB	
I/Q imbalance at 1 MHz, 1 kΩ RefLevel 1 V	Page 1.46					
I-high – Q-high		-0.1	_____	+0.1	dB	
I-low – Q-low		-0.1	_____	+0.1	dB	
Frequency response, Reference 1 MHz, 1 kΩ, RefLevel 1V	Page 1.46					
Input I-high		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz						
Input I-low		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz						
Input Q-high		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz						
Input Q-low		-0.3	_____	+0.3	dB	
5 MHz		-0.3	_____	+0.3	dB	
10 MHz						

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
I/Q imbalance, Frequency response, 1 kΩ RefLevel 1V	Page 1.46					
I-high – Q-high		-0.15	_____	+0.15	dB	
5 MHz		-0.15	_____	+0.15	dB	
10 MHz						
I-low – Q-low		-0.15	_____	+0.15	dB	
5 MHz		-0.15	_____	+0.15	dB	
10 MHz						
Spurious & Harmonics, 1 kΩ, RefLevel 1 V	Page 1.47					
Input I-high		54	_____		dBc	
12 MHz		54	_____		dBc	
30 MHz						
Input I-low		54	_____		dBc	
12 MHz		54	_____		dBc	
30 MHz						
Input Q-high		54	_____		dBc	
12 MHz		54	_____		dBc	
30 MHz						
Input Q-low		54	_____		dBc	
12 MHz		54	_____		dBc	
30 MHz						
Noise floor, 1 kΩ, balanced, RefLevel 31.6 mV	Page 1.48					
Noise voltage in 1 Hz bandwidth						
Channel Q			_____	28	nV	
Channel I			_____	28	nV	
I/Q offset, 1 kΩ, balanced , RefLevel 100mV	Page 1.48	-2	_____	2	mV	

Contents - Chapter 2 "Adjustment"

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Adjusting the frequency accuracy 2.6

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2 Adjustment

The following chapter describes the adjustment of the reference sources as well as the software-controlled adjustment of individual module data following module replacement.

The FSQ permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the FSQ
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the FSQ

The adjustment permits to maintain and restore the data integrity of the instrument.

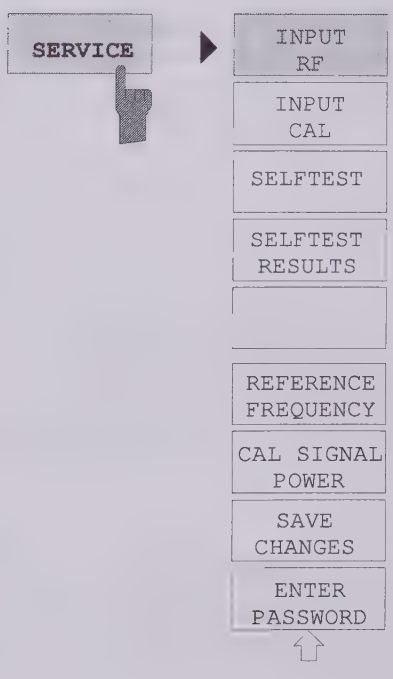
Manual adjustments must be performed at an ambient temperature between +20 °C and +30 °C after the instrument has warmed up.

After the adjustment and an internal total calibration has been performed, the FSQ is ready for use and offers full data integrity.

Service Menu

The service functions for adjusting the boards are only useable after the entry of a password to prevent impairment of instrument functionality by unintended data changes.

SETUP menu:



The *SERVICE* softkey opens a submenu for selection of the service function

Entering the Password

SETUP SERVICE submenu:

The *ENTER PASSWORD* softkey allows the entry of a password.

The FSQ contains a variety of service functions which, if incorrectly used, can impair the functionality of the analyzer. These functions are normally not accessible and are only usable after the entry of a password.

The password permits change of data which must be modified for calibration or repair of the instrument (for example reference frequency adjustment, level adjustment, general board data). The password is "894129".

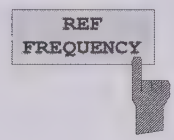
IEC/IEEE-bus command: `SYST:PASS "<Password>"`

Adjustment Functions

Caution:

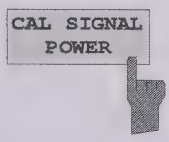
The re-alignment should be carried out by qualified personnel since any change considerably influences the measurement accuracy of the instrument. This is the reason why the softkeys REF FREQUENCY, CAL SIGNAL POWER and SAVE CHANGES can only be accessed after entering a password.

SETUP SERVICE submenu:



The *REF FREQUENCY* softkey opens the data input for the adjustment of the reference frequency. Values can be selected between 0 and 255 (without option B4 OCXO) or between 0 to 4095 (with option B4 OXCO). They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store it permanently in the nonvolatile memory.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN 155`



The *CAL SIGNAL POWER* softkey opens the data input for the adjustment of the currently set level of the calibration signal (0 dBm or -30 dBm, compare *INPUT CAL* softkey). Values can be selected between 0 and 255. They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store it permanently in the nonvolatile memory.

IEC/IEEE-bus command: --

The *SAVE CHANGES* softkey stores the modifications in the nonvolatile memory of the instrument. Since these modifications considerably influence the measurement accuracy of the instrument, confirmation by the user is requested before storing.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN:SAV`

Manual Adjustment

In the following, the measuring instruments and auxiliary means required for the manual adjustment of the FSQ, the appropriate preparations of the instrument as well as the individual adjustments will be explained.

Test Instructions

- The adjustment of the analyzer must be done after a warm-up time of at least 30 minutes and overall calibration. Only in this case can the compliance with the guaranteed data be ensured.
- Inputs for setting the FSQ during measurements are shown as following:

  [**<KEY>**] Press a key on the front panel, eg **[SPAN]**
  [<SOFTKEY>] Press a softkey, eg [MARKER -> PEAK]
  [**<nn unit>**] Enter a value and terminate by entering the unit, eg [**12 kHz**]
  Successive entries are separated by [:], eg. [**BW** : RES BW MANUAL : **3 kHz**]

Measuring Equipment and Accessories

Table 2-1 Measuring Equipment and Accessories for manual adjustment of the FSQ

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	error < $1x10^{-9}$, frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency Accuracy of Reference Oscillator
2	Signal generator	frequency range to 1 GHz: output level -10 dBm	SMHU	0835.8011.52	Calibration Source 128 MHz Frequency Accuracy of Reference Oscillator
3	Power meter		NRVD	0857.8008.02	Calibration Source 128 MHz
4	Power sensor	1 MHz to 3 GHz RSS ≤ 0.8% Meter noise ≤ 20 pW	NRV-Z4	0828.3618.02	Calibration Source 128 MHz

Adjusting the level measurement accuracy

Test equipment:

- Signal generator (Section "Measurement Equipment", item 2):
  frequency 128 MHz
  level -30 dBm
- power meter (Section "Measurement Equipment", item 3)
- power sensor (Section "Measurement Equipment", item 4)
  frequency 128 MHz
  maximum power $P_{max} \geq 1$ µW
  meter noise ≤ 20 pW
  RSS ≤ 0.8% referred to indicated power
  impedance Z = 50 Ω

Power meter settings:

➢ connect power sensor to power meter and carry out function ´ZERO´ when no signal is applied to the power sensor.

➢ connect power sensor to RF output of signal generator.

Signal generator settings:

- frequency 128 MHz
- level –30 dBm ± 0.05 dB

➢ use power meter for exact level adjustment.

Test setup:

➢ connect RF output of the signal generator to RF input of the FSQ

Overall calibration of FSQ:

- [**PRESET**]
- [**CAL** : CAL TOTAL]

FSQ settings:

- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **15 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**BW** : VID BW MANUAL : **1 kHz**]
- [**TRACE** : DETEKTOR : RMS]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]

Reference measurement

➢ set marker to peak of signal
- [**MKR SEARCH** : PEAK]

➢ set reference to peak of signal
- - [**MKR** : REFERENCE FIXED]

➢ switch internal reference generator to RF input
- [**SETUP** : SERVICE : INPUT CAL]

➢ set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Adjustment:

The reading ´Delta [T1 FXD]´ displays the difference between the output level of the signal generator and the level of the calibration source.

Caution:

The following re-alignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the FSQ, *it is strongly recommended to perform this adjustment only if the level is not within the tolerance. .*

FSQ settings:

- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : CAL SIGNAL POWER]

➢ The correction value for the calibration signal level will be displayed in the data entry field. Change the value with the step keys or spin wheel until the marker reading ´Delta [T1 FXD]´ displays a value of 0 ± 0,05 dB.

Store value in instrument

- [**SETUP :** SERVICE : SAVE CHANGES]

➢ Confirm message on display with ´YES´ . The correction values will be stored in the non volatile memory of the boards.

Note:

The changed level of the calibration source will be used with the following total calibration.

- [**CAL :** TOTAL CALIBRATION]
- [**CAL :** CALIBRATION RESULTS]

➢ Check the calibration results. The calibration must be performed with the status ´PASSED`.

Adjusting the frequency accuracy

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of FSQ) at 1 GHz or at connector EXT REF OUT (rear of FSQ) at 10 MHz using a frequency counter
For the adjustment, the FSQ must be set to internal reference.

Note: *The measurement at 1 GHz can be performed with a lower frequency counter resolution in order to achieve a faster adjustment.*

Preparations for adjustment with signal generator:

Test equipment:
- Signal generator (Section "Measurement Equipment", item 2):
  frequency 1000 MHz
  level -20 dBm
  frequency accuracy $<1x10^{-9}$

If the frequency accuracy of the signal generator is not sufficient, adjust the frequency with a frequency counter to the correct frequency before the adjustment.

Test setup:
➢ connect RF output of the signal generator to RF input of the FSQ

FSQ settings:
- [**PRESET**]
- [**FREQ** : CENTER : **1 GHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **1 MHz**]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SETUP** : REFERENCE INT / EXT]

➢ toggle to internal reference (INT)

Note: *Before the following measurement, the FSQ must warm up for at least 30 minutes to heat the reference oscillator.*

Measurement:
➢ switch on marker frequency counting:
- [**MKR** : SIGNAL COUNT]

➢ Set the necessary resolution:
Model without OCXO (Option B4) 1 GHz ± 1 kHz
- [**MKR** : **NEXT** : CNT RESOL 100 HZ]

Model with OCXO (Option B4) 1 GHz ± 100 Hz
- [**MKR** : **NEXT**: CNT RESOL 10 HZ]

Preparation for adjustment with frequency counter:

Test equipment:

Frequency counter (Section "Measurement Equipment", item 1):
error < $1x10^{-9}$
frequency range up to 10 MHz

Test setup:

➢ connect frequency counter to 10-MHz reference output of the FSQ (rear panel)

FSQ settings:

- [**SETUP** : REFERENCE INT / EXT]
➢ toggle to internal reference (INT)

frequency counter settings:

➢ Set the necessary resolution:
model without OCXO (option B4): 1 Hz
model with OCXO (option B4): 0.1 Hz

Note:

Before the following measurement, the FSQ must warm up at least 30 minutes to heat the reference oszillator.

Measurement:

➢ measure frequency with frequency counter:

nominal frequency:
model without OCXO (option B4) ..... 10 MHz ± 10 Hz
model with OCXO (option B4) ..... 10 MHz ± 1 Hz

Adjustment:

Important Note !

The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the FSQ, *it is strongly recommended to perform this adjustment only if the frequency is not within the tolerance.*

FSQ settings:

- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : REF FREQUENCY]

➢ The correction value for the reference frequency adjust will be displayed in the data entry field. Change the value with the step keys or spin wheel until the frequency counter reading or the marker count reading displays a value within the tolerance.

Store value in instrument

- [**SETUP :** SERVICE : SAVE CHANGES]

➢ Confirm message on display with ´YES´ . The correction values will be stored in the non volatile memory of the boards.

Adjustment of Module Data

All boards of the FSQ contain EEPROMS for storage of board data.
In addition to some standard information such as module name, serial number, hardware status and date of manufacture, these stored data items contain important pieces of information within value tables from module pre-testing, e.g. frequency responses for module error data.

In order to match the data stored in EEPROMs on the respective modules to the complete instrument, an adjustment of module data is always performed automatically after replacing a module:

The module header is read from the EEPROMs and compared to the contents of the associated binary file stored on the hard disk. If the header coincides with the data from the binary file it is assumed that the binary file is an exactly mapping EERPOM and the contents of the binary file is loaded in the RAM.
After replacing a module, these data usually do no longer coincide. The FSQ then detects a board replacement and starts the automatic board adjustment. The complete contents of the new module are read from the EERPOM and copied to the hard disk of the FSQ. The existing calibration data (results from the latest total calibration) are deleted and the instruments displays UNCAL. Thus, the FSQ must always be calibrated again after replacement of a module (Softkey *CAL TOTAL*).

Frequency response correction

With some boards (see chapter 3, section "Module Exchange") an frequency response correction is necessary in addition to the automatic adjustment of module data. This correction is performed by means of a software.
For information when to on perform the frequency response correction see chapter 3, section "Module Replacement".

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3 Repair

This chapter describes the design of the FSQ, simple measures for repair and troubleshooting and the replacement of modules. For troubleshooting and diagnosis, a selftest is available, which permits to poll diagnostic voltages of the modules and indicate limit violations.

The firmware update and the installation of options are described in chapter 4 of this service manual.

Instrument Design and Function Description

A detailed schematic of the FSQ design is presented in the block diagrams below and in the exploded views (see also chapter 5).
The following description of instrument functions refers to the block diagram.

Block diagram

See also chapter 5, illustrations for a detailed block diagram.

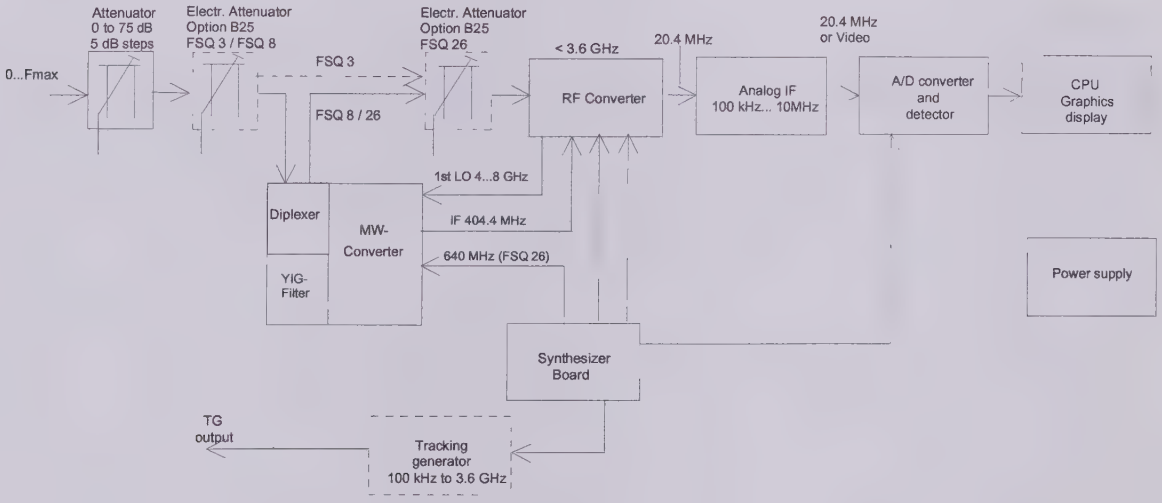


Fig. 3-1 Block diagram of instrument

Description of Block Diagram

The FSQ is a triple-conversion superhet receiver (double-conversion for receive frequencies >3.6 GHz) for the frequency range 20 Hz to 3.6 GHz, 8 GHz or 26.5 GHz (depending on the instrument model). The signals are processed by one RF board (two for models > 3.6 GHz), one IF board, one signal detection board and a controller comprising a Pentium industry PC, an I/O interface and a graphics controller. The instrument can be upgraded to meet future requirements by retrofitting options in the analog and digital sections.

The input signal is reduced in level by the attenuator and routed to the RF modules depending on the instrument type. In instruments with option FSU-B25 (electronic attenuator), this module follows in the signal path. In 3.6 GHz models the attenuator is followed by the RF converter, in the high-frequency models a diplexer is connected in between. The high-frequency signal component >3.6 GHz is routed to the microwave converter module following the diplexer. The IF module is the same in all instrument models, likewise the signal path through signal detection to the display.

The internal reference and calibration signals are generated in the frequency and level reference part on the synthesizer board. Here the 128 MHz reference frequency is generated and made available to the instrument as a reference frequency, and a level-controlled output signal is generated as an internal level reference for instrument calibration.

A detailed description of the modules is given in the following.

Attenuator

The RF signal passes from the input connector via the input switch to the attenuator, which can be set. The input signal is applied to the switch as well as a 128 MHz signal, which has a close-tolerance level of -30 dBm for calibration purposes or 0 dBm for the selftest of the instrument. Two different attenuators are used: the 8 GHz attenuator in the FSQ3 and FSQ8, and the microwave attenuator up to 26 GHz. The two attenuators switch in steps of 5 dB and have maximum total attenuation of 75 dB and an AC coupling that can be bypassed. The lower limit frequency of AC coupling is 1 MHz with the 8 GHz attenuator and < 10 MHz with the attenuator in the FSQ26.

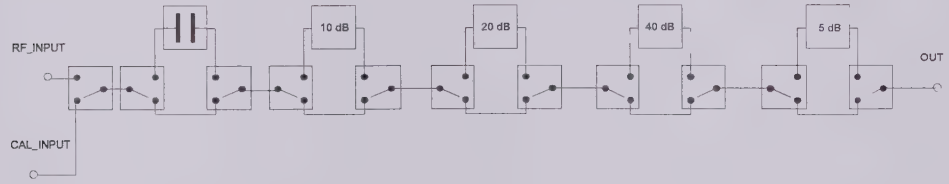


Fig. 3-2 Input attenuator

Electronic Attenuator (Option B25)

The electronic attenuator is fitted in the signal path behind the attenuator. It consists of a mechanical 5 dB attenuator pad, an electronic input attenuator, which can be switched from 0 to 30 dB in steps of 5 dB, and a switchable 20 dB preamplifier to reduce the noise figure of the FSQ.

RF to IF Conversion for Frequencies < 3.6 GHz – RF Converter

The RF converter is used to convert the signal in the reception range from 20 Hz to 3.6 GHz to a low intermediate frequency of 20.4 MHz.
The balanced input mixer first converts the input signal to an intermediate frequency of approx. 4.63 GHz. The symmetric design reduces second-order intermodulation.

The first local oscillator in the frequency range 4.63 to 8.23 GHz is implemented with a YIG-tuned oscillator. This oscillator is synchronized via several dividers to the signal from the synthesizer module (600 to 620 MHz). The balanced output of the first mixer is amplified with two bipolar transistors to avoid 1/f noise. This balanced signal is fed to a three-stage filter with dielectric resonators. Flatness and group delay of the filter are optimized for broadband vector analysis in a bandwidth of 30 MHz. The filter feeds a second mixer, which converts the signal to the second IF of 404.4 MHz. The balanced output is amplified with two amplifiers to reduce intermodulation products. The output signal from the two amplifiers is combined in a transformer to an unbalanced signal. Due to the symmetric design there is no need for transformers in the mixers so that the conversion loss is reduced.

The second IF can be filtered to a bandwidth of 10 or 20 MHz using two five-stage filters with ceramic resonators. A bypass for a 50 MHz bandwidth (= 3 dB bandwidth of the first IF Filter) can be selected also. The signal is fed to the third mixer via an attenuator pad that can be switched in steps of 1 dB. With 30 MHz FFT span the K2 of the 3rd mixer causes spurious within the band. Therefore the level has to be reduced before this mixer stage if high input levels are used (> -25 dBm). The attenuator can be used also to drive the input mixer up to +10 dBm, thus allowing for a better dynamic range in phase noise or spurious measurements with a large carrier offset (> 1 MHz).

Fast overload detectors are used to detect compression in the stages of the first and second intermediate frequency. The bandwidth of these detectors is above 100 MHz so that pulse signals can be detected as well with a preselector of the same width. The output signal of the detector on the second IF is also used with a logarithmic amplifier as an RF power trigger with a dynamic range of 70 dB.

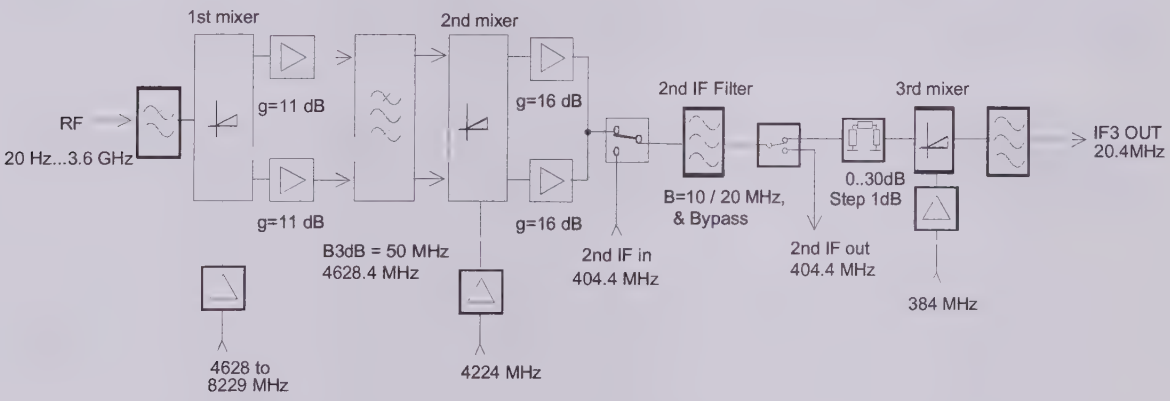


Fig. 3-3 Conversion of the RF to the third IF from 20 Hz to 3.6 GHz

RF to IF Conversion for Frequencies > 3.6 GHz - MW Converter

The high-frequency models of the FSQ (frequency range > 3.6 GHz) also comprise a microwave converter board. After the RF attenuator, the input signals are fed to the microwave converter and split up in the diplexer to frequencies below 3.6 GHz and above 3.6 GHz. Signals below 3.6 GHz are forwarded to the RF converter like in the FSQ3. Signals above 3.6 GHz are taken via the YIG filter to the mixer, where they are directly converted to the 2nd IF of 404.4 MHz.

The YIG filter can be bypassed by means of a relay.

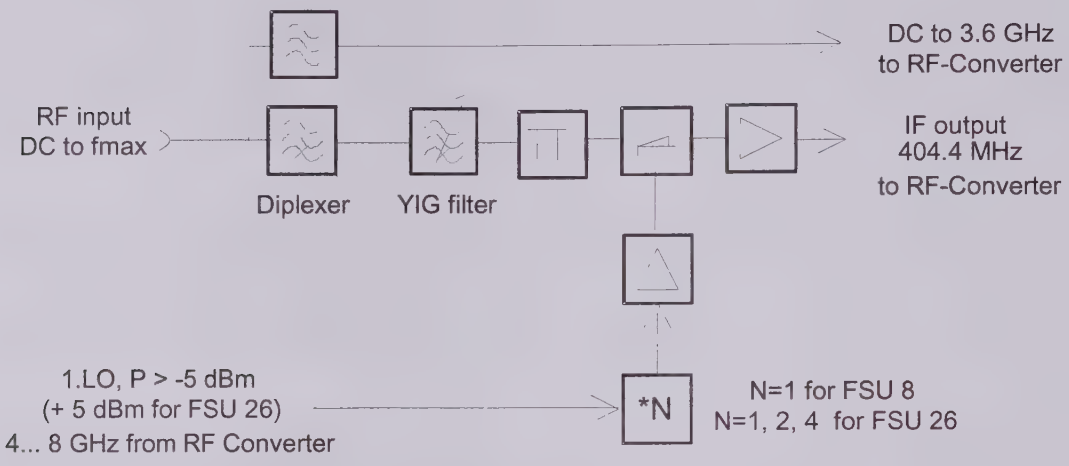


Fig. 3-4 Conversion of the RF to the IF from 3.6 GHz

The first LO converts the input frequency to the 404.4 MHz IF. For this purpose the LO signal (4 GHz to 8 GHz) generated in the RF converter is amplified to the required LO level. The FSQ26 has two additional doubler stages which can be bypassed and generate the LO signal for conversion to 26.5 GHz.

The basic model is equipped with the necessary interfaces (IF input 404.4 MHz, LO output 4 to 7.6 GHz) for extending the frequency range by simply adding a microwave converter.

IF Filter Module

The RF converter is followed by the analog IF filter module:

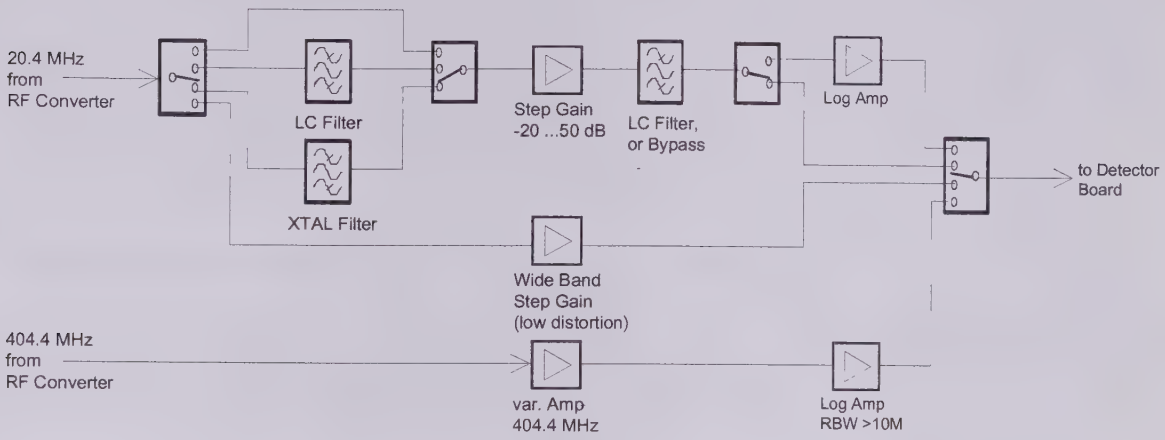


Fig. 3-5 IF filter

The FSQ offers resolution bandwidths from 1 Hz to 20 MHz in steps of 1/2/3/5. For the bandwidths above 5 MHz, the selection filter is provided in the RF converter. There is no selection at the 20.4 IF, a logarithmic amplification to 404.4 MHz is performed.
The tunable bandwidths 100 kHz to 5 MHz are at the 3rd IF (20.4 MHz) on the IF filter module. The bandwidths 100 kHz to 5 MHz are provided by 5 LC circuits.
The step gain can be set from -20 to 50 dB in 0.1 dB steps and is adjusted as a function of the reference level and the input attenuation.
The IF filters are followed by a log detector to obtain the dynamic range of the display.
A limiting amplifier in the log amp provides the TTL output for the frequency counter.

With a 10 bandwidth the LC filters are bypassed, however step gain and log amp are used as with the analog bandwidths between 200 kHz and 5 MHz.

For the digital resolution filters from 10 Hz to 100 kHz, the 20.4 MHz IF signal at the IF filter output is routed to the A/D converter. With bandwidths below or equal to 30 kHz, a two-stage crystal filter is used to prevent the step gain and the ADC from being overdriven. This filter can be tuned from about 2.5 to 70 kHz in bandwidth. With the bandwidths 50 kHz and 100 kHz, the LC filter is set to about 400 kHz for the same reason.

An additional path without any filtering is used for the broadband vector analysis. The step gain is optimized for low distortion, as with a bandwidth of 30 MHz at a center frequency of 20.4 MHz the harmonics of the IF are also present at the input of the ADC.

The FSQ contains an AM/FM demodulator on the IF filter. In the spectrum analysis mode, the signal applied at the position of the reference marker can be demodulated during the sweep. For this purpose, the FSQ stops the frequency sweep for a selectable period of time and demodulates the input signal. The volume is set using the spinwheel on the front panel (AF OUTPUT). The demodulator bandwidth corresponds to that of the input filter in the case of digital filters. To ensure a good reception, the 30-kHz filter should be used, the filter preceding the demodulator being at approx. 70 kHz then.

Processing of Measured Data - Detector Board

The chapters below explain the signal and data paths required for result processing in the various operating modes:

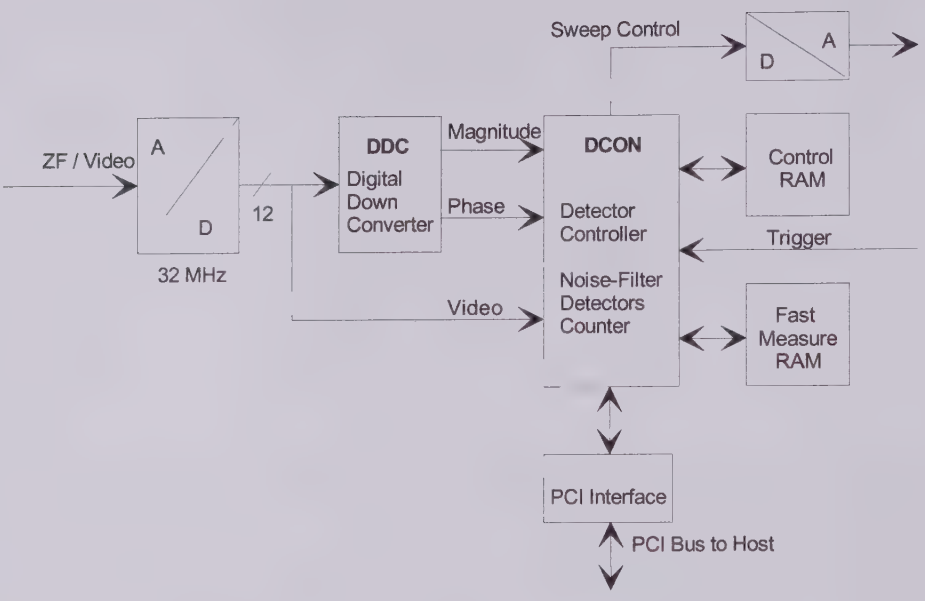


Fig. 3-6 Processing of measured data

Spectrum Analysis Using an RBW >100 kHz

In this mode only the analog resolution filters on the IF filter board are used. The signal applied to the A/D converter via the input IF/Video is therefore already a log video signal. The signal is continuously sampled at 64 MHz in the ADC and digitized.
The signal path is now directly routed to DCON.

In the DCON, the data are directly applied to the noise filter. The noise filter serves for limiting the video bandwidth or for averaging the noise content. The signal path is routed to the detector logic where the results are processed, ie peak max, peak min, sample, average and RMS values as well as the number of measured max. peak, min. peak, sample, average, RMS and quasi peak values are determined.

With measurement data rates > 1 MHz, detector data have to be stored in the measurement RAM because online storage is no longer possible at these high speeds. Upon completion of the sweep, the sweep data are read by the host from the measurement RAM, processed and displayed.

Spectrum Analysis Using an RBW ≤ 100 kHz

In this operating mode the resolution bandwidths are generated digitally with the aid of the WDDC (wideband digital down converter). The IF filter module provides an IF signal pre-filtered at 20.4 MHz. The WDDC mixes the input signal into the complex baseband using an NCO, and then filters the obtained I/Q signal via an HDF (high decimation filter) and an FIR (finite impulse response) filter. The magnitude and phase are calculated from the I/Q data and transferred to a second gate array in the DCON. As in operating mode RBW > 100 kHz, the signal is video-filtered and weighted depending on the set detector.

FFT Bandwidths

In FFT bandwidth mode, the synthesizer is set to the desired frequency via the DCON, which also generates the tuning voltages for the analog hardware. The signal path is routed via ADC, Corr RAM and WDDC. The WDDC first mixes the input IF into the baseband using an NCO; then the obtained I/Q signal is filtered in an HDF (**h**igh **d**ecimation **f**ilter) and FIR stage (**f**inite **i**mpulse **r**esponse). The I/Q output data is then transferred by the WDDC to the SDRAM controller, which stores the data in SDRAM1 or SDRAM2. With data logging completed the I/Q data from the SDRAM controller is fetched from the SDRAM, transferred to the PCI interface, which transmits the I/Q data to the memory of the host. The host then performs the FFT for this sweep section.

Video Bandwidths (VBW)

The video filters of the FSQ can be adjusted between 1 Hz and 10 MHz in steps of 1/2/3/5. They are designed as a digital lowpass filter for the video signal. The video bandwidth can either be coupled to the resolution bandwidth (= default setting) or manually set to a fixed value.

Detectors

The FSQ uses a detector for the positive peak (peak+) and one for the negative peak value (peak-). In the sample mode, the video signal can also be directly sampled by the A/D converter without a peak detector being required. *Quasi-Peak, Average* and *RMS* detectors are available in addition. The RMS detector forms the rms value of the input signal for one point in the display during the measurement time.

1st Local Oscillator- RF Converter

The 1st local oscillator is a YIG oscillator on the RF converter. It is synchronized via a fractional N divider to the synthesizer signal of 600 to 620 MHz or 20 to 40 MHz. This signal can be set with very high resolution in steps of less than MHz. With 20 to 40 MHz a whole octave can be swept with one divider setting. This setting is used with a fast sweep time over big spans. The 600 MHz setting is used with spans below 200 MHz because of the better phase noise.

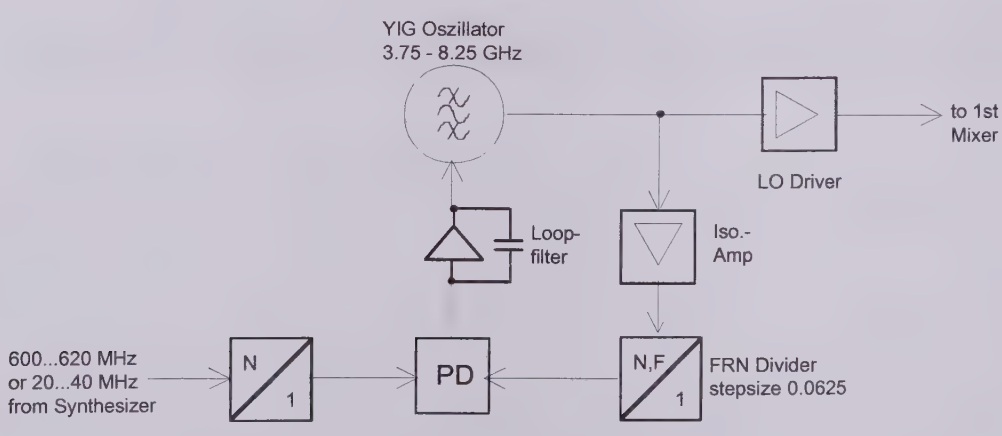


Fig. 3-7 Synchronization of 1st local oscillator

2nd Local Oscillator - Synthesizer

The second local oscillator is a DRO (dielectric resonator oscillator) on the synthesizer board at 4224 MHz. This oscillator is synchronized to a harmonic of the 3rd LO (384 MHz). This type of oscillator features excellent phase noise values.

3rd Local Oscillator- Synthesizer

The third oscillator is a VCO with ceramic resonator, which is synchronized via a mixer to the third harmonic of the crystal oscillator at 128 MHz.

Reference Frequency 128 MHz – Synthesizer

This reference is generated on the synthesizer board. To ensure perfect phase noise performance an SC cut crystal is used as resonator. The oscillator is synchronized with a bandwidth of approx. 30 Hz to the internal 10 MHz reference or to an external reference.

Harmonics of this signal are used for the synchronization of the 3rd local oscillator and the sweep oscillator 600 to 620 MHz.

It is also used for generation of the 128 calibration signal via automatic level control. The level can be switched between 0 dBm and -30 dBm and adjusted with a D/A converter.
A 4:1 divider generates the 32 clock for the detector board (A/D converter).

Reference Frequency 10 MHz – Synthesizer

The reference frequency is generated by an OCXO, the frequency is adjustable by a D/A converter. If the external reference input is used, this OCXO is switched off and the external signal is used instead.

OCXO Reference (Option B4)

The FSQ contains the option B4, an oven-controlled reference oscillator with extra low aging and improved phase noise at 10-Hz offset. If the option is fitted, this OCXO is used instead of the OCXO on the synthesizer board. If an external reference is used, both OCXOs are switched off. The heater of the B4 option stays on.

Sweep VCO - Synthesizer

The sweep VCO on the synthesizer board is used to synchronize the YIG oscillator on the RF converter. An oscillator with ceramic resonator at approx. 600 MHz is used. This VCO can be tuned over quite a small range of about 20 MHz for good phase noise performance. A bigger tuning range would reduce the quality factor of the resonator. The oscillator is mixed with a comb line of the 128 crystal oscillator to an IF between 20 and 40 MHz. Via this IF the VCO is synchronized to a digitally generated signal from a fractional N divider. This signal can be tuned in steps of smaller than 1 MHz in frequency. For small spans with a good phase-noise performance, the YIG oscillator is synchronized to the VCO, for fast sweeps and a big span to the IF.

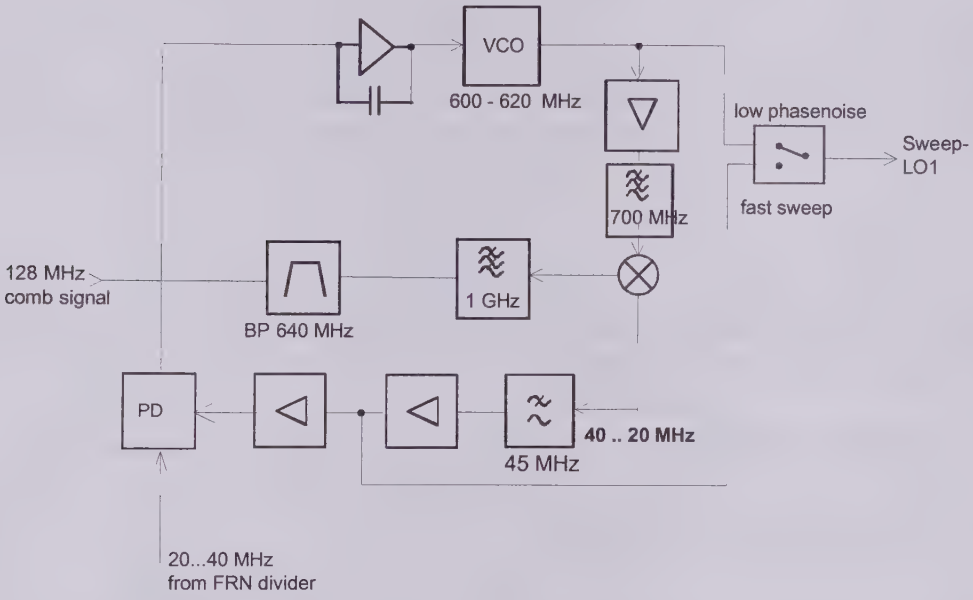


Fig. 3-8 Sweep synthesizer

Front Panel

The front panel consists of a mounting plate which accommodates the LCD, the keyboard mat with the membrane and the spinwheel. The case panel incorporates the front-module controller.

LCD
The colour LCD provides a visible output of any information, measurements etc. to the user. The resolution of the LCD is 800 * 600 pixels (SVGA).
The display incorporates a cold cathode tube for the illumination. The high voltage required for this purpose is generated in an extra DC/AC converter mounted next to the display on the mounting plate and connected both to the display and the controller board via a cable.

Keyboard
The keyboard consisting of a keyboard mat and a membrane releases a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (yellow for STANDBY/green for ON) are also accommodated on this membrane.
The key evaluation and LED control are effected via a film cable connector on the controller board. Like the control of the two LEDs, control is performed in a special microprocessor on the controller board by means of a matrix technique. This microprocessor permits to store the status of the STANDBY/ON key when switching off using the power switch.

Front module controller
The front module controller contains all the necessary components on a board such as processor, memory chips (SIMM modules), I/O devices (ISA bus), lithium battery, IEC/IEEE-bus controller, two

serial interfaces (COM1/2), a parallel interface (LPT), LCD graphics controller, external VGA monitor graphics interface (monitor) and an external keyboard connection (keyboard PS/2).
In addition, a floppy controller for an external floppy disk drive and an IDE hard disk controller are integrated on the controller board.
The LAN interface is also integrated on the controller board of the FMR6.

Hard disk
The hard disk is screwed to the rear panel of the front module controller and connected to the printed circuit board via a ribbon cable.

Power Supply Module

The power supply module provides all currents necessary for the operation of the FSQ. It can be switched off by means of the power switch on the rear panel.
The power supply module is a primary-clocked switching power supply with power factor correction (PFC) and standby circuit (+12 V standby).

On the secondary side, it generates DC voltages (+3.3 V; +5.2 V; +6 V; +8 V; +12 V; +12 VFAN; +12 V standby; +28 V; -12 V).

The control signal STANDBY/ON controlled by the front module controller (depending on the operating key STANDBY/ON on the front of the instrument frame) activates the power supply. In standby operation, it only supplies the 12-V standby voltage for the crystal oscillator and the LED STANDBY on the front panel.

The secondary voltages are open-circuit-proof and short-circuit-proof with respect to ground and each other.
An overtemperature protective circuit is additionally installed to prevent overheating. This status is taken to the front module controller via a status signal (*OT*).

Fuses
Two fuses are also fitted in the power supply as a means of fire protection.

Note: *These fuses are not accessible to the user from outside and are only blown in the case of a serious fault of the power supply (servicing required!).*

Motherboard

The motherboard generates the -6 V supply for the analog boards with an integrated DC/DC converter.
The noise source output (28 V noise source) is also generated on this board.
All external supplies (probe, keyboard, etc) are short-circuit-protected by polyswitches (current-dependent, self-opening and closing fuses).

On the motherboard, a circuit for temperature-dependent instrument fan control is also implemented.

Probe / Keyboard
The probe / keyboard PCB is located at the front of the instrument frame and accommodates the external interfaces KEYBOARD (PS/2) and PROBE POWER connector. For connection with the motherboard a ribbon cable is used.

Volume / Phones
The volume/phones board is located on the front mounting plate and accommodates the external interfaces PHONES (headphones connector) and the volume control (rotary encoder) for the AF demodulator.
For connection with the motherboard a ribbon cable is used.

Module Replacement

This section describes in detail the replacement of modules. Chapter 5 provides information on how to order spare parts; it contains the list of mechanical parts with order numbers and the illustrations for board replacement.

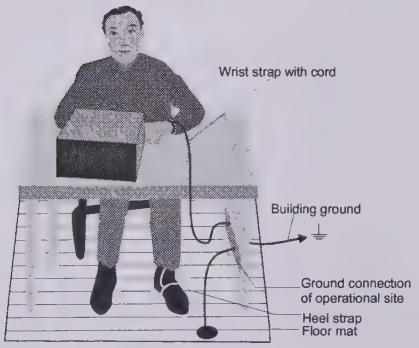
Note: *The numbers indicated in brackets refer to the position in the list of mechanical parts in chapter 5.*

1155.5001 (FSQ Basic Model, Its. 1-455),
1129.9032 (Dig. Basic Unit, Its. 500-775),
1093.4708 (Display Unit, Its. 800-950),
1144.9017 (option FSU-B4, Its. 1100-1130).
1144.9300 (option FSU-B25, Its. 1400-1460)
1129.7246 (option FSP-B10. Its. 1600-1630)
1142.9090 (option FSU-B9, Pos. 1800-1960)
1142.9361.00 (option FSU-B12, Its. 2400-2445)
157.0136.00 (Option FSQ-B71, Its. 2700-27280)

Note: *The words "left" and "right" in the manual always refer to the front view of the instrument.*

Caution!

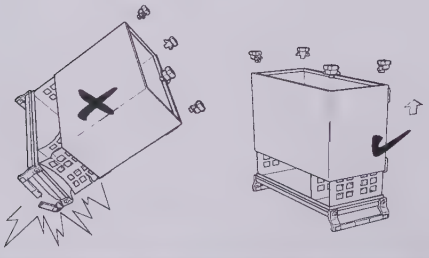
- *Please observe the safety instructions at the beginning of this manual.*
- *Disconnect the instrument from the mains before opening the case.*
- *Protect the replacement site against electrostatic discharge to avoid damage to electronic components of the modules.*



- *The following two methods of ESD protection may be used together or separately:*
-

- Wrist strap with cord to ground connection

- Conductive floor mat and heel strap combination



- *Put the instrument on the front handles before loosening the rear feet and the enclosure to avoid damage to the instrument.*
- *When mounting the enclosure take care not to damage or pull off cables.*

Performing a Cold Start

As of firmware version 1.6x, a cold start has to be performed as described below each time a module containing an EEPROM has been replaced.

- Switch the instrument on by pressing the ON key.
- Wait until the controller issues a beep.
- Press the decimal point key and hold it down until the BIOS message is displayed on the screen, e.g.

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2

02/12/2002-io815E-LPC47B2-6A69REFC2C-00
```

After this, NT starts the device firmware.

Overview of the Modules

Table 3-1 Overview - module replacement

Module	Required tests and adjustments after replacement		
	Function tests and system error correction	Adjustment	Other
Front module controller	SYSTEM MESSAGES/ SELFTEST / CAL		DOS/BIOS update
Lithium battery	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Hard disk	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot / FW update
LCD / DC/AC-converter			
Keyboard membrane or mat			
Front cover			
Floppy disk drive	Check of directories		
Power supply	SYSTEM MESSAGES/ SELFTEST / CAL		
Fan			
RF input connector	SELFTEST / CAL	Frequency response	
Motherboard	SYSTEM MESSAGES/ SELFTEST / CAL		EEPROM entry
RF attenuator	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	
Key probe and vol./phone	Voltage / keyboard / volume		
RF Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	
Detector	SYSTEM MESSAGES/ SELFTEST / CAL		
IF filter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ cal. source	
MW converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ frequency response	
OCXO B4	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy	
External Generator Control FSP-B10	SYSTEM MESSAGES/ SELFTEST / CAL		
LAN interface B16			
Removable HD B18			
Flash Disk -B20			
Electr. Attenuator -B25			
External Generator Control -B10	SYSTEM MESSAGES/ SELFTEST / CAL		
Baseband Inputs -B71	SYSTEM MESSAGES/ SELFTEST / CAL		
Tracking Generator -B9	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	
Attenuator for Generator -B12	SYSTEM MESSAGES/ SELFTEST / CAL		

Replacing the Front Module Controller A90

(see chapter 5, spare parts list, item 570 and illustrations 1155.5001 and 1129.9032)

The front module controller is mounted behind the front panel.

Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- FSU3/8 up to delivery date 2002:
  Remove volume control knob (47) by pushing off the front hood and undoing the screw.
- Pull off the front cover (270) towards the front.
- Undo two countersunk screws (610) in the front frame each on the top and at the bottom.
- Remove the front panel with keyboard and display (600, 621, 631, 641, 650, 660) towards the front and turn it to the top of the instrument.

Caution!
Note that the connecting cables are still connected to the controller.

- Disconnect the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane, spinwheel and, if required, network connector.

  Note: *When removing the connecting cables be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

Removing the Front Module Controller

➢ Undo the 10 screws with washers (590) of the front module controller board and take out the front module controller as follows (see also Fig. 3-9):

Note: *The front module controller is tightly inserted on the motherboard.*
It can be pulled off towards the front using the slots at the bottom of the mounting plate.
Carefully push the board towards the front step by step using a flat, blunt tool.

Caution:

Do not insert the tool too far into the slots and press only against the PC board !
To pull out the board lever off at all slots alternately.
The board must not be bent!

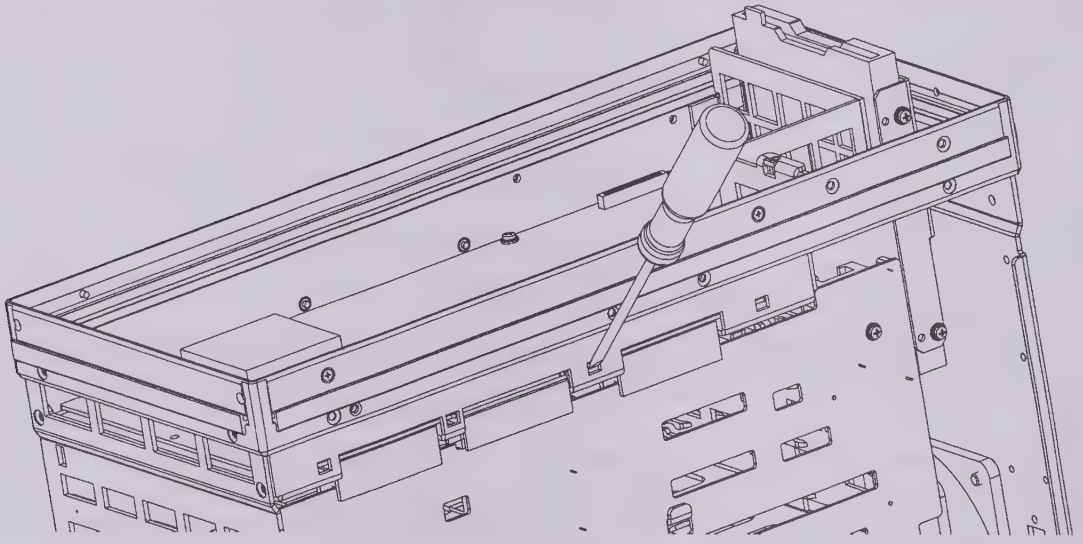


Fig. 3-9 Removing the front module controller

Installing the New Front Module Controller and Completing the Instrument

- Carefully plug the new front module controller to the motherboard and fasten it in place using the 10 screws with washers (590).

  Caution: Short-circuits might occur between controller components, lines and screws (590) on the FMR6, 1091.2520.00. Place an insulating mat underneath!

- Carefully plug the cable connectors to the controller board, taking care not to reverse the polarities.

Front Module Controller Typ FMR6

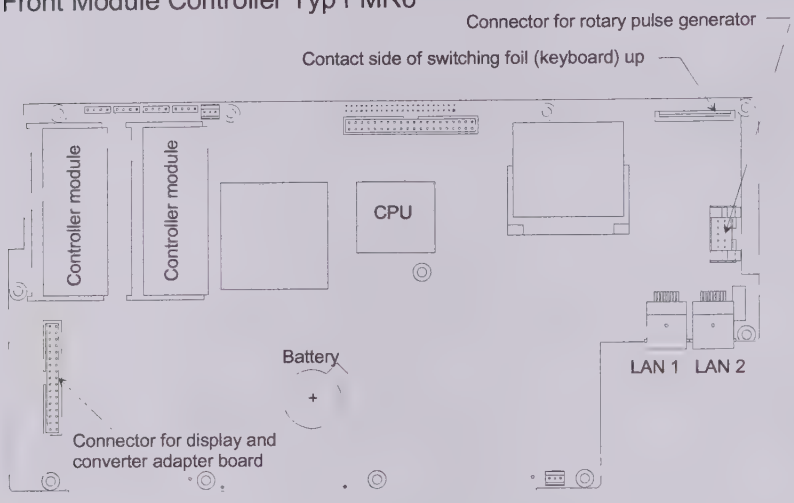


Fig. 3-10 Position of connectors on front module controller

- Rotate the front panel into the FSQ and fasten in place using 4 countersunk screws (610) in the front frame.

Caution!
Make sure to route the cables properly.

- Install the front cover (270).
- Mount the 2 front handles (420) on the instrument using the 4 screws (430).

Putting into Operation

- Connect the instrument to AC supply and switch on the power switch. The instrument is now in stand-by mode.
- Insert a floppy disk with DOS and BIOS update into the floppy disk drive.
- Switch on the FSQ and wait until the first beep. Press the FILE key. The BIOS update starts.
- During programming the flash EEPROM, the FSQ must not be switched off.
- Follow the message indicated in the display, then switch the FSQ off and on.
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST] , then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the Lithium Battery on the Front Module Controller

(see chapter 5, spare parts list, item 776 and illustrations 1155.5001 and 1129.9032)

The lithium battery is accommodated on the front module controller board behind the front panel.

Caution!

Lithium batteries must not be exposed to high temperatures or fire.

Keep away from children.

If the battery is replaced improperly, there is danger of explosion. Only replace the battery by an R&S type (see chapter 5, spare parts list, item 775 for type FMR5 and item 776 for type FMR6).

Lithium batteries are hazardous waste and must be disposed of in dedicated containers.

Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- FSU3/8 delivered up to 2002:
  Remove volume control knob (47) after removing the cap and undoing the screw.
- Pull off the front cover (270) towards the front.
- Undo two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 621, 631, 641, 650, 660) towards the front and rotate it to the top of the instrument.

Caution!

Note that the connecting cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, network connector from the front module controller.

Note: *When removing the connecting cables be careful with the cable to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

Removing the Lithium Battery

➢ Carefully lift and remove the battery.

Note: *3.4 V lithium battery (∅ 20 mm * 3 mm) R&S Order No. 0858.2049.00*

Front Module Controller Typ FMR6

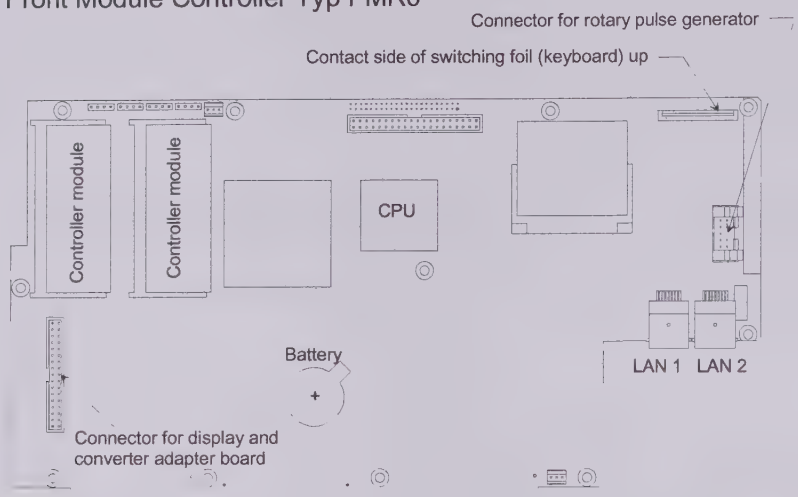


Fig. 3-11 Position of lithium battery on front module controller

Installing the New Battery and Completing the Instrument

Caution!
Do not short-circuit the battery.

➢ Insert battery into holder below the spring.

Note: The positive pole (+) of the battery points up.

➢ If necessary, replace the mechanical lock (cable clamp). First solder the positive terminal to the PC board, then the negative terminal.

➢ Plug jumper JP12 to position 1 and 2 on the front module controller (position before battery replacement).

➢ Rotate the front panel back into the FSQ and fasten in place using 4 countersunk screws (610) in the front frame.

Caution!
Make sure to route the cables properly.

➢ Install the front cover (270).

➢ Mount the 2 front handles (420) again using the 4 screws (430).

Putting into Operation

- Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.
- After battery replacement, a cold boot is required. See chapter „Performing a Cold Start".
- After starting the instrument check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing the Hard Disk A60

(see chapter 5, spare parts list, item 710, and illustrations 1155.5001 and 1129.9032)

The hard disk is located between the front module and the boards.
The spare part contains the complete software.

Opening the Instrument and Replacing the Hard Disk

- Switch off the instrument, disconnect the AC supply plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- Undo the two countersunk screws (260) on the top of the instrument and the two screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Disconnect the ribbon cable (720) at the hard disk.
- Undo the two countersunk screws (740) on the hard disk mounting plate (730).
- Take the hard disk (710) with the mounting plate (730) out of the FSQ.
- Undo the 4 countersunk screws (750), remove the hard disk and mount a new hard disk to the mounting plate (730).

Installing the New Hard Disk and Putting into Operation

- Mount the hard disk with the mounting plate into the instrument using two screws (740).

  Note: *Be careful with the lower cover plate locking in the concerning opening.*

- Connect the ribbon cable (720) to the hard disk.

  Note: *Connect cable according to illustration 1093.4537 in chapter 5 .*

- Place the top cover (240) onto the instrument and fasten in place using two countersunk screws (260) and 2 screws with washers (250).
- Mount the enclosure (410) and fasten the 4 rear-panel feet (450) using screws.
- Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.
- After replacement of the hard disk, a cold boot is required. See chapter "Performing a Cold Start".
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the LCD and DC/AC Converter in the Front Module

(see chapter 5, spare parts list, items 601, 921 and 871, and illustrations 1155.5001, 1129.9032 and 1093.4708)

The LCD is accommodated on the mounting plate together with the associated DC/AC converter. It is connected to the front module controller via cables, which can also be replaced individually. For replacement proceed as follows:

Opening the Instrument and Removing the Front Module

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo two countersunk screws (610) in the front frame at the top and at the bottom.
- Pull out the front module with keyboard and display (600, 621, 631, 641, 650, 660) towards the front as far at it goes.

Caution!
Note that the connecting cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, network connector on the front module controller.

  Note: *When removing the connecting cables be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

- Place the front module with the keys onto a clean surface.

Removing the DC/AC Converter

- Pull off the connecting cable from the display (921) to the DC/AC converter (871).
- Disconnect cable (907) to DC/AC converter (871).
- Remove the DC/AC converter (871) after undoing the two screws (892).

Removing the LCD

- Undo the two screws (950) and remove the display connector (949).
- Disconnect cable (948) from the display (921).
- Loosen the 4 screws with washers (930) and remove the display (921).

Installing the New LCD and/or DC/AC Converter and Putting into Operation

- To insert the new LCD and/or DC/AC converter proceed in the reverse order, connect all cables in the correct position and tighten all screws (drawing 1093.4708).
- Place the front panel with the keys on top of the instrument so that the cables can be connected to the front module controller.
- Carefully plug the cable connectors to the controller board without reversing the polarities.

Front Module Controller Typ FMR6

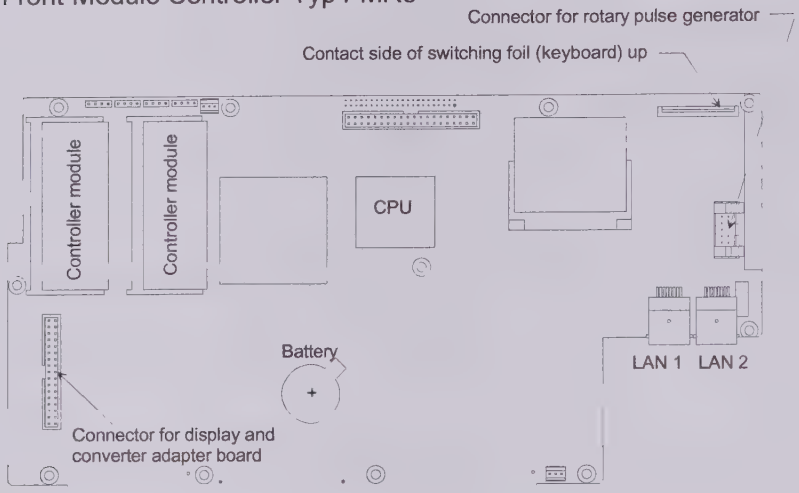


Fig. 3-12 Position of connectors on front module controller

- Rotate the front panel back into the instrument and fasten it in place using 4 countersunk screws (610) in the front frame.

Caution!

Make sure to route the cables properly.

- Install the front cover (270).
- Mount the 2 front handles (420) again using the 4 screws (430).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing the Keyboard Membrane or Mat on the Front Module

(see chapter 5, spare parts list items 631 and 641, and illustrations 1155.5001 and 1129.9032)

The keyboard membrane is the contact film for the rubber keys (mat) behind the front cover and the keyboard frame.

Opening the Instrument and Removing the Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo two countersunk screws (610) in the front frame at the top and at the bottom.
- Pull out the front module with keyboard and display (601, 621, 631, 641, 650, 660) towards the front and put it on top of the instrument with the keys facing the instrument.

Caution!
The cables are still connected to the controller .

- Disconnect the connecting cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, the network connector.

Note: *When removing the cables be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

Removing the Membrane

- Place the front panel onto a clean surface with the keys pointing upwards.
- Pull off the knob (650) of the spinwheel.
- Loosen the 10 countersunk screws (660) and remove the keyboard frame (621).
- The keyboard membrane (641) as well as the mat (631) can now be replaced.

Installing the New Membrane and Completing the Instrument

➢ Insert the new mat (631) into the keyboard frame (621) from the back.

Note: *The pins of the mat must be inserted into the holes at the keyboard frame.*

➢ Position the new keyboard membrane (641) on the back of the mat (631).

Note: *Push the foil cable of the membrane through the slot in the mounting panel. The membrane must be positioned so that the pins of the mat are inserted into the holes in the membrane.*

➢ Position the mounting plate with the display on the membrane (641).

Note: *The display must be positioned so that the pins of the mat are inserted in the holes in the mounting plate (805).*

➢ Press the front panel together, turn the keys to the top and fasten in the keyboard frame using 10 countersunk screws (660).

➢ Place the front panel with the keys on the top of the instrument so that the cables can be connected to the front module controller.

➢ Carefully plug the cable connectors to the controller board without reversing the polarities.

Front Module Controller Typ FMR6

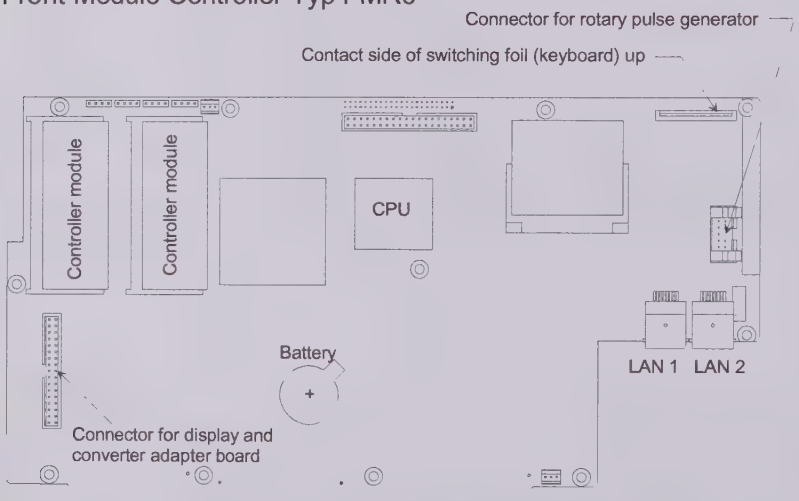


Fig. 3-13 Position of connectors on front module controller

➢ Rotate the front panel back into the FSQ and fasten it in the front frame using 4 countersunk screws (610).

Caution!
Make sure to route the cables properly.

➢ Install the front cover (270).

➢ Mount the 2 front handles (420) using the 4 screws (430).

➢ Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing the Front Cover on the Front Module

(see chapter 5, spare parts list, items 270/280/290, and illustration 1155.5001)

The front cover is the outer front panel that carries the labels. Every model has its own front cover (270, 280, 290).

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Install the new front cover and reassemble the instrument in the reverse order.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing the Floppy Disk Drive A30

(see chapter 5, spare parts list, item 670, and illustrations 1155.5001 and 1129.9032)

Opening the Instrument and Removing the Floppy Disk Drive

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the two countersunk screws (260) on the top of the instrument and the two screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Remove two screws (700) at the fan side of the FSQ and carefully pull out the floppy disk drive (670) with the floppy mounting plate (680) pointing towards the top.

  Note: *The cable is still connected to the motherboard.*
- Disconnect the cable at the floppy disk drive.

  Note*: Please note the correct direction of the cable (contact side).*

Installing the New Floppy Disk Drive and Completing the Instrument

- Undo the 3 screws with washers (700) and remove the floppy disk from the mounting plate (680) and mount a new disk drive (670) to the floppy mounting plate (680).
- Connect the cable (690) to the disk drive (note the contact side of the cable).
- Insert the floppy mounting plate (680) and fasten it to the fan side using two screws with washers (700).

  Note: *Please mount the floppy disk drive in the middle of the front-panel breakout.*
- Replace the instrument cover (240) on the top and fasten it in place using two countersunk screws (260) and 2 screws with washers (250).
- Push the enclosure (410) onto the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Function Test

- The instrument is booting and the firmware is starting.
- Insert a 3 ½" disk with any files.
- Press the FILE key, then the FILE MANAGER and EDIT PATH softkeys.
- Enter "a" and ":" and confirm with the Enter key.
- The directory structure of the inserted disk must be displayed on the screen.

Replacing the Power Supply A20

(see chapter 5, spare parts list, item 550, and illustration 1129.9032)

The power supply is fitted at the rear of the instrument frame.

Removing the Power Supply

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- Undo the 10 screws (560) at the rear of the power supply.
- Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.

Installing the New Power Supply

- Place the instrument onto the front handles and install the new power supply in the reverse order.

  Note: *Make sure that the 96-contact connector to the MOTHERBOARD locks in place correctly.*
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the AC supply and switch it on.
- After starting the instrument check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the Fan

(see chapter 5, spare parts list, item 15, and illustration 1155.5001)

The fan is fitted at the right side of the frame.

Opening the Instrument and Removing the Fan

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the two countersunk screws (260) on the top of the instrument and the two screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Remove the fan (15) by loosening the 4 screws.
- Disconnect the fan cable at the motherboard connector X35 (FAN) .

Installing the New Fan and Completing the Instrument

- Connect the fan cable to the motherboard connector X35 (FAN)
- Mount the new fan using 4 screws.

  Note: *Please note the direction of the airflow printed on the fan. The fan must blow the cold air into the instrument.*

  Make sure to route the cable so that it cannot get into the fan.
- Replace the instrument cover (240) on the top and fasten it in place using two countersunk screws (260) and 2 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Replacing the RF Input Connector (Cable W1) FSQ3/8

(see chapter 5, spare parts list, item 295, and illustration 1155.5001)

The RF input connector is fitted at the bottom right side of the front panel.
Depending on the frequency range different cables W1 are available.

Opening the Instrument and Removing the Cable W1

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Remove 3 countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (60 or 61).
- Unscrew the cable W1 (295) to 7 GHz or W1 (315) to 30 GHz at the RF attenuator (20) or (30).
- Remove the connector mounting plate (60 or 61) together with W1 and the probe/key module (50) towards the front.

Note: *The probe/key module (50) is connected by a ribbon cable to the motherboard X80.*

- Undo the 4 countersunk screws (350) and remove cable W1 together with mounting plate (330) or (340).

Installing the New Cable and Completing the Instrument

- Put the mounting plate (330) or (340) onto the new cable W1 and fasten it in place using 4 countersunk screws (350), insert the mounting plate (60 or 61) into the instrument and screw it to attenuator (20) or (30).
- Fix 3 countersunk screws (70) in the instrument frame and one countersunk screw (70) in the mounting plate (60 or 61).
- Install the front cover (270).
- Mount the 2 front handles (420) again using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary.

Replacing the RF INPUT Connector (Casing Adapter) FSQ26

(see chapter 5, spare parts list, Item 315, and illustration 1155.5001)

The input connector is at the bottom right of the front panel. Different connectors are used depending on the frequency range of the instrument.

Opening the Instrument and Removing the Casing Adapter

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Remove the 4 screws at the left and right front handles (430) and take off front handles.
- Pull off front cover (290) towards the front.
- Remove 3 countersunk screws (70) from frame and 1 countersunk screw (70) from mounting plate (61).
- Unscrew input cable W1 (316) from attenuator (25).
- Pull out mounting plate (60) together with cable W1 and the probe/key (50) and vol./phone board (43) modules towards the front.

  ***Note**: The probe/key (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.*

- Remove cable W1 together with mounting plate (340) after undoing 4 countersunk screws (350).
- Unscrew casing adapter (315) from cable W1 (316).

Installing the Casing Adapter and Completing the Instrument

- Screw new casing adapter (315) to cable W1 (316).
- Connect mounting plate (340) to cable W1, fasten it with 4 countersunk screws (350), fit it into the instrument together with mounting plate (61) and screw it to the attenuator (21).
- Fasten mounting plate (61) to instrument frame with 3 countersunk screws (70) and to mounting plate (61) with 1 countersunk screw (70).
- Remount the 2 front handles (420) by means of 4 screws.
- Slide on enclosure (410) and screw on the 4 rear-panel feet (450).
- Connect the AC supply cable, switch on power switch and press the ON key.
- Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response as described in Chapter 1 and correct it, if required.

Replacing the Motherboard A10

(see chapter 5, spare parts list, item 510 or 511 and illustrations 1155.5001 and 1129.9032)

The motherboard is located at the bottom.

Opening the Instrument and Removing the Motherboard

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the two countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on the side frame and remove all cables to the boards.
- Pull out all boards towards the top of the instrument.

  Note: *The boards can be disconnected from the motherboard by carefully pressing from the bottom through the motherboard slots.*

- Remove the power supply (550).
  Undo the 10 screws (560) at the rear of the power supply.
  Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Undo two countersunk screws (610) in the front frame at the top and at the bottom.
- Remove the front panel with keyboard and display (600, 621, 631, 641, 650, 660) towards the front.

Caution:
Note that the cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and spinwheel and, if required, the network connector on the front module controller.

  Note: *When removing the cables be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

- Remove the front module controller (see chapter "Replacing the Front Module Controller A90")
- Remove the screws of all motherboard connectors at the rear panel. Unscrew the bolts (530) at the COM and LPT ports and (540) at the Monitor port. Unscrew the nuts at the Noise Source and Ext. Trig connectors and the bolts at the IEC port.

  Note: *Do not change the bolts of the Monitor and the LPT or COM ports !*

- Disconnect the cables at the motherboard (RF attenuator, fan, floppy, probe/key, rear panel, etc).
- Undo seven screws with washers (520) at the lower side of the motherboard (510 or 511).
- Carefully pull the motherboard (510 or 511) towards the front panel (approx. 15 mm) and take it out of the instrument by swiveling down.

Installing the New Motherboard and Completing the Instrument

- Reinstall the motherboard in the instrument in the reverse order.

  Note: *Be careful when installing the motherboard in order not to cause damage to any components.*

- Make *sure to connect* the *cables according to their labels.*
- Insert the front module controller, front panel, power supply, boards and cables, top cover, enclosure and rear-panel feet in the reverse order.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Store the serial number of the instrument to the EEPROM:
  - [**SETUP** : SERVICE : ENTER PASSWORD "30473035"] , then input serial number of the instrument in HW-Info table (see also chapter 2, section "Automatic Adjustment of Module Data").

Replacing the RF Attenuator A40

(see chapter 5, spare parts list, items 20 and 25, and illustration 1155.5001)

The RF attenuator is fitted at the bottom behind the RF input connector.

Opening the Instrument and Removing the RF Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place the instrument onto the left side and unscrew the RF cable or the diplexer (150) at the output of the RF attenuator.
- FSQ3/8: Undo the two screws with washers (40) at the instrument frame.
  ***Note**: The RF attenuator is then only held via the RF cables at the front.*
- FSQ26: Undo the 3 screws with washers (28) at the instrument frame.
  ***Note**: The RF attenuator is then only held via the RF cables at the front.*
- Hold the attenuator and disconnect RF cable W1 (295) on the FSQ3/8 or cable W1 (316) on the FSQ26 from the input of the RF attenuator.
- Carefully take out the RF attenuator and unscrew the flexible RF cable from the input.
- Disconnect ribbon cable from motherboard connector X41 on the FSQ3/8 or at X40 on the FSQ26.
- Only FSQ26: Remove RF attenuator (25) by undoing 4 countersunk screws (27) from insulating plate (26).

Installing the New RF Attenuator and Completing the Instrument

- Only FSQ26: fasten new attenuator (25) to insulating plate (26) with 4 countersunk screws (27).
- Connect ribbon cable to motherboard connector X41 on the FSQ3/8 or to X40 on the FSQ26.
- Connect the flexible RF cable to the input of new RF attenuator (see label on cable)
- Install the new RF attenuator in the instrument and connect cable W1 (295) on the FSQ3/8 or RF cable W1 (316) on the FSQ26 to the input.
- FSQ3/8: Fasten the attenuator to the instrument frame using the two screws with washers (40).
  FSQ26: Fasten the attenuator to the instrument frame using the 3 screws with washers (28).
- Fasten the RF cable to the RF output of the RF attenuator.
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch. The instrument is now in the standby mode.
- After replacing the attenuator, a cold start is required as of firmware version 1.6x. See chapter „Performing a Cold Start“
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary.

Replacing Key/Probe Module A80 and Vol./Phone Board A191

(see chapter 5, spare parts list, items 43 and 50, and illustration 1155.5001)

The boards are located behind the front-panel connectors Keyboard, Probe, Headphones and the volume control knob.

Opening the Instrument and Removing the Boards

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take out the enclosure (410) towards the back.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) towards the front.
- Remove volume control knob (48).
- Pace the instrument onto the left side so that its bottom side is accessible.
- Remove 3 countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (60 or 61).
- Unscrew the input cable W1 (295) or (315) at the RF attenuator (20) or (30).
- Remove the mounting plate (60 or 61) completely with W1 and Probe/Key board (50) and optional Vol./Phone board (1040) towards the front.

  ***Note**: The Probe/Key (50) and Vol./Phone (43) boards are connected to X80 and X81 on the motherboard via a ribbon cable.*

- Disconnect the cables of the two boards from motherboard connectors X80 and X81.
- Undo the 3 countersunk screws (55) and remove the Probe/Key board (50).
- Undo the 3 countersunk screws (46) and remove the Vol./Phone board (43) from the mounting plate (60 or 61).
- Undo the screw with washer (45) and the nut of the volume control at the mounting bracket (44) and remove the Vol./Phone board (43).

Installing the New Modules and Completing the Instrument

- Fasten the new Probe/Key board (50) to the mounting plate (60 or 61) using 4 countersunk screws (55).
- Fasten the new Vol./Phone board (43) to the mounting bracket (44) using the nut of the volume control and one screw with washer (45). Mount Vol./Phone board (43) to mounting plate (60 or 61) using two countersunk screws (46).
- Connect the cables of the two boards to motherboard connectors X80 and X81.
- Carefully slide the complete mounting plate (60 or 61) back into the instrument.

Caution

Make sure to route the cables properly.

- Screw RF cable W1 (295) or (315) to the input of the RF attenuator (20) or (30).
- Mount 3 countersunk screws (70) to the instrument frame and one countersunk screw (70) to the mounting plate (60 or 61).
- Install the front cover (270).
- Mount the volume control knob (48).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).

Function Test

- Connect an appropriate keyboard to the keyboard socket.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Simultaneously press the CTRL and ESC keys on the keyboard, the Windows NT task bar will appear at the lower edge of the screen.
- Shift the cursor to MAINAPP using the trackball and click. The task bar will disappear.
- Measure the output voltages at the probe connector (see Fig. 3-14).

Pin	Signal
1	GND
2	-12.6 V
3	+15 V

Fig. 3-14 Pin assignments of PROBE POWER connector

- Test the function of headphones connector and volume control. Press the *MKR* key, press the *MARKER DEMOD* softkey. Noise can be heard in the loudspeaker, the volume can be changed using the *VOLUME* knob at the front panel. Connect headphones to the *AF OUTPUT* at the front panel. The loudspeaker is switched off and the noise can be heard in the headphones.

Replacing the RF Frontend A100

(see chapter 5, spare parts list, item 100, and illustration 1155.5001)

The board is located in the middle of the instrument .

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the two countersunk screws (260) on the top of the instrument and the two screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side frame and remove all cables connecting the board.
- Pull out board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labels on the motherboard.*
- Replace the instrument cover (240) on the top and fasten it in place using two countersunk screws (260) and 2 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable, switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start".
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary, using the correction software.

Replacing the Synthesizer A110

(see chapter 5, spare parts list, item 105, and illustration 1155.5001)

The board is located in the middle of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left. of the instrument to the left side and take off.
- Place the instrument on its side and remove all connecting cables to the board.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 2 countersunk screws (260) and 2 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing acold start".
- After starting the instrument check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency response according to chapter 1 and correct, if necessary, using the correction software.

Replacing the Detector A140

(see chapter 5, spare parts list, item 110, and illustration 1155.5001)

The board is located in the front part of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board.
- Pull out the board towards the top of the instrument.

  Note: *The module can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect all RF cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on the power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a cold start".
- After starting the instrument check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]

Replacing the IF Filter A130

(see chapter 5, spare parts list, item 120, and illustration 1155.5001)

The board is located in the middle of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull out board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: Please observe the labeling on the motherboard.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.
- As of firmware version 1.6x, a cold start is required after replacement of the IF Filter. See chapter „Performing a cold start".
- After starting the instrument check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency accuracy and the calibration source level according to chapter 1 and readjust according to chapter 2, if necessary.

Replacing 8 GHz Converter Unit A160; FSQ8

(see chapter 5, spare parts list, items 130 to 140, and illustration 1155.5001)

The board is located in the middle of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull out the board towards the top of the instrument.

  Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a cold start".
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing Diplexer A162; FSQ8

(see chapter 5, spare parts list, item 2030 and illustration 1130.2544)
The board is located on the 8 GHz converter unit.

Removing the Diplexer on MW Converter 11130.2369

- Remove 8 GHz converter unit (130).
  *Note: See description "Replacing 8 GHz Converter Unit A160; **FSQ**8".*
- Disconnect cable W1 from diplexer (2030).
- Undo 4 screws with washers (2035) from the bottom of the PCB.
- Remove diplexer (2006) perpendicularly to the PCB.
  Note: The diplexer is still attached to the PCB with contact pins.

Installing the Diplexer on MW Converter 1130.2369

- Plug in new diplexer (2030) perpendicularly to the PCB.
  Note: The diplexer is attached to the PCB with contact pins.
- Refasten 4 screws with washers (2035) to the bottom of the PCB.
- Fit cable W1 to diplexer (2030).

Completing the Instrument and Frequency Response Correction

- Put 8 GHz converter unit (130) back into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160; FSQ8.
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing 8 GHz YIG Unit A161; FSQ8

(see chapter 5, spare parts list, items 2015 and 2020, and illustration 1130.2544)
The board is located on the 8 GHz converter unit.

Note: *Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.*

Removing the 8 GHz YIG Unit

- Remove 8 GHz converter unit (130).
  *Note: See description "Replacing 8 GHz Converter Unit A160; **FSQ**8".*
- Remove the two module covers by undoing the screws from the bottom of the module.
- Disconnect cable W1 from the diplexer (2030) and cable W2 from the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, disconnect the cable from the YIG filter at X4.
- Undo 2 countersunk screws (2025).
- Remove the complete YIG unit (2015 or 2020).
  Note: YIG Unit 1130.2944.04 (2015) is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.

Installing the 8 GHz YIG Unit

- Place the new YIG unit (2015 or 2020) on the PCB.
  Note: YIG Unit 1130.2944.02 (2015) is connected to the PCB via contacts. Plug the YIG unit into the connector contacts from the top perpendicularly to the PCB.
- Fasten the YIG unit with 2 countersunk screws (2025).
- Screw on cable W1 to the diplexer (2030) and connect cable W2 to the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, connect the cable from the YIG filter at X4.
- Fit the module cover onto the top of the converter unit (positioning by means of adjusting pins). Turn 8 GHz converter unit upside down, place module cover on the bottom side and refasten all screws.

Completing the Instrument and Frequency Response Correction

- Place the 8 GHz converter unit (130) into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160;FSQ8".
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing the Relay on the MW Converter Unit; FSQ8

(see chapter 5, spare parts list, item 2060 and illustrations 1130.2544 and 1130.2815)
The relay is located on the 8 GHz converter unit.

FSQRemoving the Relay from the MW Converter

- ➢ Remove the 8 GHz converter unit (130).
  Note: See description "Replacing 8 GHz MW Converter Unit A160; 8".
- ➢ Disconnect cables from the relay unit (2040) to the diplexer (2030) and to the YIG unit (2015 or 2020).
- ➢ Disconnect the relay supply cable (2065) on module X2.
- ➢ Undo 2 screws (2050) and remove the two relays with cables.
- ➢ Unscrew all cables from the relay and unsolder supply lines (2065).

Installing the Relay on MW Converter

- ➢ Solder supply lines (2065) to the relay.

Note: For pin assignment see sheet 1130.2815

- ➢ Refasten all cables to the relay.
- ➢ Place the relay unit (2040) on the support (2045)and refasten it to the MW converter using 2 screws (2050).
- ➢ Connect relay supply cable (2065) to module X2.
- ➢ Reconnect cables between the relay unit (2040) and the diplexer (2030) and YIG unit (2015 or 2020).

Completing the Instrument and Frequency Response Correction

- ➢ Place the 8 GHz converter unit (130) back into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160; FSQ8".
- ➢ Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing 26.5 GHz MW Converter Unit A160; FSQ26

(see chapter 5, spare parts list, item 140 and illustration 1155.5001)

The board is located in the middle of the instrument.

Opening the Instrument and Removing the Module

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the cover (240) of the instrument to left side and take off.
- Place the instrument on its side and remove all RF cables from the module at the bottom of the instrument.
- Pull out the module towards the top of the instrument.

Note: *The module can be disconnected from the motherboard connector by carefully pushing it upwards from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new module into the instrument and reconnect all RF cables.

Note: *Please observe the labeling on the motherboard.*

- Put the top instrument cover (240) back into place and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.
- As of firmware version 1.6x, a cold start is required after replacement of the MW Converter Unit. See chapter „Performing a cold start“.
- After starting the instrument check if the protocol file is correct:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing Diplexer A161; FSQ26

(see chapter 5, spare parts list, item 2105 and illustration 1130.3240, sheet 2)
The board is located on the 26.5 GHz MW converter unit.

Removing the Diplexer

- Remove 26.5 GHz converter unit (140).
  Note: See description "Replacing 26.5 GHz MW Converter Unit A160; FSQ26"
- Disconnect all cables from diplexer (2105).
- Undo 4 screws with washers (2110) from the bottom of the PCB.
- Remove diplexer (2006) perpendicularly to the PCB.
  Note: The diplexer is still fitted to the PCB with contact pins.

Installing the Diplexer

- Plug in new diplexer (2105) perpendicularly to the PCB.
  Note: The diplexer is fitted to the PCB with contact pins.
- Refasten 4 screws with washers (2110) to the bottom of the PCB.
- Refasten all cables to the diplexer (2110).

Completing the Instrument and Frequency Response Correction

- Put 26.5 GHz MW converter (140) back into the instrument.
  Note: See description "Replacing 26.5 GHz MW Converter A160; FSQ26"
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing 26.5 GHz YIG Unit A162; FSQ26

(see chapter 5, spare parts list, item 2117 and illustration 1130.3240, sheet 2)

The board is located on the 26.5 GHz MW converter unit.

Note: Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.

Removing the 26.5 GHz YIG Unit

- Remove 26.5 GHz MW converter unit (140).
  Note: See description "Replacing 26.5 GHz MW Converter Unit A160; FSQ26"
- Disconnect cable W1 from the diplexer (2105) and cable W2 from the relay unit (2170).
- Disconnect cable from YIG filter at X4.
- Undo 3 cover screws holding the YIG unit (2115) from the bottom of the module.
- Undo 2 countersunk screws (2120).
- Remove the complete YIG unit (2115).

Installing the 26.5 GHz YIG Unit

- Put the new YIG unit (2115) on the PCB.
- Fasten YIG unit with 2 countersunk screws (2120).
- Refasten 3 cover screws holding the YIG unit (2115) to the bottom of the module.
- Reconnect cable W1 to the diplexer (2105) and cable W2 to the relay unit (2170).
- Connect cable from the YIG filter to X4.

Completing the Instrument and Frequency Response Correction

- Put 26.5 GHz converter unit (140) back into the instrument.
  Note: See description "Replacing 26.5 GHz MW Converter Unit A160; FSQ26".
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing the Extender 26 A163; FSQ26

(see chapter 5, spare parts list, item 2125 and illustration 1130.3240)
The board is located on the 26.5 GHz MW converter unit.

Removing the Extender 26

- Remove 26.5 GHz MW converter unit (140).
  Note: See description "Replacing 26.5 GHz MW Converter Unit A160; FSQ26".
- Disconnect all cables from Extender 26 (2125).
- Undo all cover screws from the bottom side of the module and remove cover (2165).
  Note: The cover on the top (2160) thus comes off.
- Undo 7 screws with washers (2130) from the Extender 26 (2125) at the bottom side of the module.
  Caution: The Extender 26 (2125) may drop out.
- Remove the Extender 26 (2125) perpendicularly to the PCB.
  Note: The Extender 26 is still fitted to the PCB with contact pins.

Installing the 26.5 GHz YIG Unit

- Plug in the new Extender 26 (2125) perpendicularly to the PCB.
  Note: The Extender 26 is connected to the PCB by means of connector contacts.
- Refit 7 screws with washers (2130) to the Extender 26 (2125) at the bottom of the module.
- Fit the module cover (2160) onto the top of the 26.5 GHz MW converter unit (positioning by means of adjusting pins). Turn 26.5 GHz MW converter unit upside down, fit module cover (2165) to the bottom side and refit all screws.
- Reconnect all cables to the Extender 26 (2125).

Completing the Instrument and Frequency Response Correction

- Put 26.5 GHz MW converter (140) back into the instrument.
  Note: See description "Replacing 26.5 GHz MW Converter A160; FSQ26"
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing the Relay on the MW Converter Unit; FSQ26

(see chapter 5, spare parts list, item 2300 and illustration 1130.3240, sheet 2, and 1130.3405)
The relay is located on the 26.5 GHz converter unit.

Removing the Relay from the MW Converter

- Remove the 26.5 GHz converter unit (140).
  Note: See description "Replacing 26.5 GHz MW Converter Unit A160; 26".
- Disconnect cables from the relay unit (2170) to the diplexer (2105), YIG unit (2117) and Extension (2125).
- Disconnect the relay supply cable (2305) on module X2 and route the cable through the module slot and connect it to the rear.
  Undo the screw (2195) at the rear of the module to remove the clamp (2190).
- Undo 2 screws (2180) and remove the two relays with cables.
- Unscrew all cables from the relay and unsolder the supply lines (2305).

Installing the Relay on the MW Converter

- Solder supply lines (2305) to the relay.
  Note: For pin assignment see sheet 1130.3405.
- Refasten all cables to the relay.
- Refasten the relay unit (2170) to the MW converter using 2 screws (2180) .
- Route relay supply cable (2305) through the module slot from the rear and connect it to module X2.
- Connect the cable (2305) with clamp (2190) and screw (2195) to the rear of the module.
- Refasten cables between the relay unit (2170) and diplexer (2105) and YIG unit (2117) and Extension (2125).

Completing the Instrument and Frequency Response Correction

- Place the 8 GHz converter unit (130) back into the instrument.
  Note: See description "Replacing 8 GHz Converter Unit A160; FSQ8".
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

Replacing the Tracking Generator A170 (Option: B9)

(see chapter 5, spare part list, item 1800, and illustrations 1155.5001 and 1142.9090)
The board is fitted in the rear part of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables to board at the bottom of the instrument.
- Pull out the board towards the top of the instrument.

Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.

  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a cold start".

- After starting the instrument check the log file for system messages:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check according to chapter 1, option Tracking Generator –B9.

Replacing the Generator Attenuator A171 (Option: B12)

(see chapter 5, spare part list, item 2400, and illustrations 1155.5001 and 1142.9361)
The board is fitted in the rear part of the instrument (behind the fan).

Opening the Instrument and Removing the Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables W41 - X2 and W49 - X1 to tracking attenuator (2400).
- Disconnect flat cable of tracking attenuator (2400) on motherboard connector X270.
- Undo the 3 screws with washers (2420) and remove attenuator with holder.
- Undo the 2 screws M3 (2415) and remove the tracking attenuator (2400).

Installing the New Attenuator and Completing the Instrument

- Mount Tracking Attenuator (2400) with 2 screws M3 (2415) to attenuator holder (2410).
- Insert Tracking Attenuator with attenuator holder into unit and mount 3 screws with washers (2420).
- Connect flat cable of Tracking Attenuator (2400) to motherboard connector X270.
- Connect cable W41 - X2 and W49 – X1 to Tracking Attenuator.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a cold start".

- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check according to chapter 1, option Tracking Generator –B9 and Option Attenuator –B12.

Replacing the OCXO A200 (Option: B4)

(see chapter 5, spare parts list, item 1100, and illustrations 1155.5001 and 1144.9017)

The board is fitted in the front part of the instrument.

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables to board at the rear of the instrument.
- Pull out the board towards the top of the instrument.

Note: *The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.

Note: *Please observe the labeling on the motherboard.*

- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.
- As of firmware version 1.6x, a cold start is required after replacement of the OCXO. See chapter „Performing a Cold Start".
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check frequency accuracy according to chapter 1 and readjust according to chapter 2, if necessary.

(see chapter 5, spare parts list, item 1500, and illustrations 1155.5001 and 1145.0259)
The board is located on the top right of the front panel.

Replacing the Electronic Attenuator A50 (Option: B25)

(see chapter 5, spare parts list, item 1400 and illustrations 1155.5001 and 1144.9300)
The board is located below the fan.

Opening the Instrument and Removing the Module

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place instrument on its side and remove RF cables on both sides of the electronic attenuator (1400).
- Undo 4 screws with washers (1460) from the trough.
- Carefully remove electronic attenuator (1400).
- Connect flat cable (1410) to electronic attenuator (1400).

Installing the Module and Completing the Instrument

- Refit flat cable (1410) to new electronic attenuator (1400).
- Carefully reassemble new electronic attenuator (1400) and screw it to trough using 4 screws with washers (1460).
- Refit RF cables to both sides of electronic attenuator (1400).
- Push enclosure (410) back in place and fix 4 rear-panel feet (450) by means of screws.
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start".
- After starting the instrument check if the protocol file is correct:
  - [SETUP : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [CAL : CAL TOTAL], then [CAL RESULTS]
- Check frequency accuracy according to chapter 1 and adjust according to chapter 2, if required.

Replacing the External Generator Control A210 (Option: B10)

(see chapter 5, spare parts list, item 1600, and illustrations 1155.5001 and 1129.7298)

The board is fitted in the front part of the instrument .

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 2 countersunk screws (260) on the top of the instrument and the 2 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Pull out the board towards the top of the instrument.

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start“.
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

Replacing the Baseband Input (Option: B71)

Replacing the Baseband Input 1 A270 (Option: B71)

(see chapter 5, spare parts list, item 2700, and illustrations 1155.5001 and 1157.0136)

The board is fitted in the front part of the instrument .

Opening the Instrument and Removing the Board

- Switch off unit, disconnect from power supply, unscrew 4 rear-panel feet (450) and pull off enclosure (410) towards rear.
- Unscrew 10 countersunk screws (260) and 3 screws with washers (250) and take off top cover (240).
- Remove 4 screws (430) at left and right front handles (420) and take off front handles.
- Pull off front cover (270) towards the front.
- Place the instrument on its side and remove all connecting cables to board A270.
- Disconnect flat cable of A270 on motherboard connector X82.
- Undo the 3 screws (2760) on mounting plate (61)
- Pull out the board towards the top of the instrument.

Installing the New Module and Completing the Instrument

- Insert the new A270 'Baseband Input 1' (2700) into subassembly plate (61) and mount 3 screws (2760).
  Note: the component side of A270 is beside the Floppy Drive.
- Connect flat cable of A270 to motherboard connector X82.
- Reconnect the cables to A270.
  ***Note**: Please observe the labeling on the board.*
- Mount front cover (270).
- Remount 2 front handles (420) by means of 4 screws (430).
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.
- After starting the instrument check the log file for system messages:
  - [SETUP : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [SETUP : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [CAL : CAL TOTAL] , then [CAL RESULTS]
- Check according to chapter 1, option Baseband Input –B71.

Replacing the Baseband Input 2 A260 (Option: B71)

(see chapter 5, spare parts list, item 2710, and illustrations 1155.5001 and 1157.0136)
The board is fitted in the middle of the instrument .

Opening the Instrument and Removing the Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables to board at the bottom of the instrument.
- Pull out the board towards the top of the instrument.
  Note: *The board can be disconnected from the motherboard connector by carefully pressing from thebottom through the motherboard slots.*

Installing the New Module and Completing the Instrument

- Plug the new board into the instrument and reconnect the cables.
  Note: *Please observe the labeling on the motherboard.*
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start".
- After starting the instrument check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES **]**
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL] , then [CAL RESULTS]
- Check according to chapter 1, option Baseband Input –B71.

Troubleshooting

Malfunctions may have simple causes but may also be caused by faulty components.

These troubleshooting instructions allow for locating the error causes down to board level and make the instrument ready for use again by means of board replacement. For troubleshooting and diagnosis, a selftest is available which polls diagnostic voltages of the modules and displays limit value violations.

We recommend to ship the instrument to our experts in the service centers (see address list at the beginning of this manual) for module replacement and further error elimination.

Warning!

Do not plug or unplug boards prior to disconnecting them from the AC supply!

Be careful not to cause short-circuits when measuring voltages!

The following utilities are provided in the FSQ for diagnosis purposes:

- Permanent monitoring of levels and frequencies in the instrument
- Selftest
- System error correction

Note: *When problems occur, first check whether any connections (cables, plug-in connections of boards etc.) are damaged or wrongly connected.*

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S-Order No.	Use
1	DC meter		URE	0350.5315.02	Troubleshooting
2	Spectrum analyzer	Frequency range 0 to 7 GHz	FSEB 20	1066.3010.20	Troubleshooting
3	Adapting cable	1m long SMP-to-SMA connection	-	1129.8259.00	Troubleshooting
4	Adapting cable	0.5m long SMP-to-SMP connection	-	1129.8265.00	Troubleshooting
5	Adapter board	Extension 150 mm high 48-contact, 2 mm spacing	-	1100.3542.02	Troubleshooting

Troubleshooting Switch-on Problems

- **Error: FSQ cannot be switched on.**

Action	Possible error causes and further steps
Check power-on switch on the rear ⇓ Check yellow LED (stand-by). ⇓	Power switch OFF: Switch on power supply. LED remains dark: ➢ Measure voltage at X20.D24 (power supply unit) Rated value: +12 V ± 1V Voltage o.k.: Keyboard or controller faulty. No voltage: Remove IF filter or OCXO modules. ➢ Measure voltage at X20.D24 (power supply unit): Rated value: +12 V ± 1V Correct voltage: Removed module faulty No voltage: Power supply faulty or short-circuit at 12V standby.
Switch on instrument. Check green LED ⇓	LED remains dark: Measure PWR-ON signal on the power supply X20.B1: < 1V for ON Voltage > 1V: Keyboard membrane or controller faulty.
Power supply starts, screen remains dark?	Measure voltages on the motherboard, see "Short-circuit of one or more operating voltages".

- **Error: Short-circuit of one or more operating voltages**

Action	Possible error causes and further steps
Check on the bottom of the motherboard which of the voltages is short-circuited: Computer, hard disk, EEPROMs : X20.A7 to A10: rated value: +5 V2 Wideband detector unit: X20.A5 and X20.A6: rated value +3 V3 Analog boards: X130.A10: rated value +12 V X130.A9: rated value +8 V X130.A8: rated value +6 V X130.A12: rated value –12 V	One voltage is missing or very small: Remove the respective boards from the instrument one by one and repeat the measurement. If the voltage is supplied, then, the error is probably located on the module removed. ***Note:*** *The power supply switches off all voltages after a short time in case of a short-circuit. Restart by pressing the Standby/On key.*

- **Error: Fan does not work.**

Action	Possible error causes and further steps
Check voltage at connector: X35 pins 1 + 3 : Rated value 7V	If there is no voltage, the fan is defective: Replace fan If the voltage is too small, the fan is blocked or the power consumption is too high.

Troubleshooting Problems with Booting

- **Error: FSQ does not start the measurement application.**

Following switch-on, the FSQ first boots the computer BIOS. After successful initialization of the computer, the Windows NT operating system starts up. Subsequently, the test application is loaded as start-up program. Simultaneously, selftests are performed at various locations and error messages, if any, are output. The messages are disabled with normal operation, but can be enabled for troubleshooting purposes. It is advisable for troubleshooting to connect a keyboard to the keyboard socket.

Normal action

Error and error cause

➢ Start FSQ

Subsequent to switching on the FSQ, the following BIOS message is displayed:

```
Award Modular BIOS v4.51PG, An Energy Star Ally
Copyright (C) 1984-97, Award Software, Inc.

R&S FSQ FMR 5 BIOS V1.0-22-1
        ----------------------------------------------------
        | Rohde&Schwarz GmbH & Co KG      |
        | Analyzer BIOS V1.0              |
        ----------------------------------------------------

06/24/99-i430TX-67X-2A59IED4C-00
```

After the first beep, the computer starts the hardware test and the message:

```
, ESC to skip Memory test...
```

is shortly displayed at the lower edge of the screen.

The test results are usually not displayed. If errors occur during the boot procedure, these messages may indicate defects.

➢ The messages can be made visible by pressing the "DISP" key following the beep. The keystroke is acknowledged by a second beep.

Then, all messages are displayed.

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2

Main Processor : Intel Pentium III 700 MHz(100x7.0)
Memory Testing: 261120K OK  + 1024 Shared Memory
                (= result of memory test)

02/12/2002-io815E-LPC47B2-
6A69REFC2C-00
```

If no result of the memory test is indicated, the memory is defective.

The memory test yields the memory capacity of the front module controller. The basic version of FMR6 provides 256 Mbyte. BIOS then starts to check the controller hardware. All PCBs found are displayed.

Normal action

➢ This procedure may be interrupted using the "PAUSE" key on the connected external keyboard, any other key continues the program execution.

Error and error cause

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2

Main Processor : Intel Pentium III 700 MHz(100x7.0)
Memory Testing: 261120K OK + 1024 Shared
Memory

Primary Memory Cvlock is 100 MHz
Primary Master : IBM-DJSA-205 JS100AB0A
        (depending on installed hard disk))
Primary Slave  : None
Secondary Master : None
Secondary Slave  : None

02/12/2002-io815E-LPC47B2-6A69REFC2C-00
```

If this hard disk entry is missing, the hard disk may be faulty

Then, the SETUP is displayed.

➢ This procedure may also be interrupted using the "PAUSE" key.

The contents partly depends on the hardware provided:

Award Software Inc.
System Configurations

CPU Type	: Intel Pentium III	Base Memory	: 640K
Co-Processor	: Installed	Extended Memory	: 260096K
CPU Clock	: 700 MHz	Cache Memory	: 256
Diskette Drive A	: 1.44M, 3.5 in.	Display Type	: EGA/VGA
Diskette Drive B	: None	Serial Port(s)	: 3F8
Hard disk Drive C	: LBA, ATA 66, 5001 MB	Parallel Port(s)	: 378
Hard disk Drive D	: None	EDO DRAM at Row(s)	: None
		SDRAM at Row(s)	: 2 3
		Display Cache Size	: None

PCI device listing.....

Bus No.	Device No.	Funct No.	Vendor /	Device ID	Class	Device Class	IRQ
0	2	0	8086	1132	0300	Display Cntrlr	10
0	31	1	8086	244B	0101	IDE Cntrlr	14
0	31	2	8086	2442	0C03	Serial Bus Cntrlr	11
0	31	3	8086	2443	0C05	SMBus Cntrlr	NA
0	31	4	8086	2444	0C03	Serial Bus Cntrlr	9
1	8	0	8086	2449	0200	Network Cntrlr	11
1	13	0	162F	1212	FF00	Unknown PCI Device	11

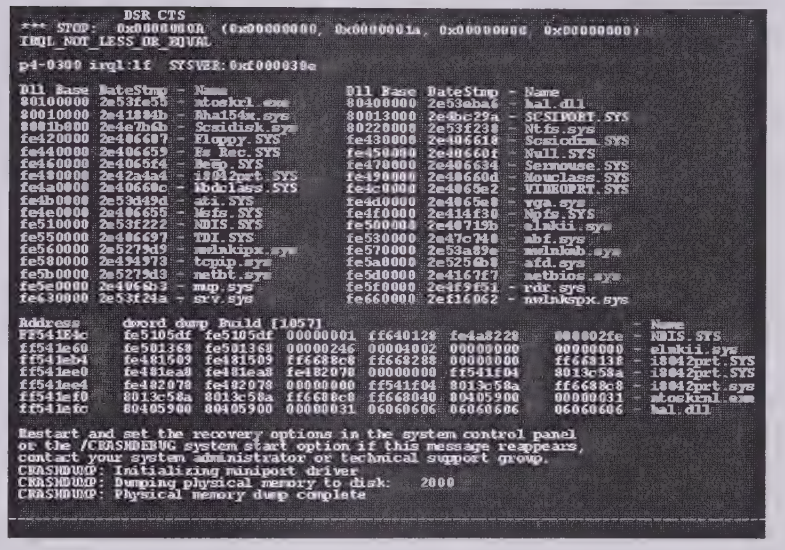
Normal action	Error and error cause
The PCI hardware test is displayed in the lower half of the screen. All modules found during the test are displayed with their names and PCI device IDs. The Device Class column lists the types of PCI device. The wideband detector unit of the FSQ is indicated as "Unknown PCI Device".	If the line "Unknown PCI Device" is missing, the wideband detector unit has not been identified and the measuring application cannot be started. If the remaining PCI devices have all been identified, the wideband detector unit will probably contain the error, which is why the board must then be replaced.
After this test, the BIOS has been loaded and the operating system is started.	The message "No System Disk or Disk error ..." at this point indicates that the contents of the hard disk are not correct. Replace the hard disk.
After successful installation of Windows NT, the following selection menu is displayed: **OS Loader V4.00** **Please select the operating system to start:** **Windows NT Workstation Version 4.00** **Windows NT Workstation Backup** **Use ↑ and ↓ to move the highlight to your choice.** **Press Enter to choose.** **Seconds until highlighted choice will be started automatically: 0** **NT Detect V4.0 Checking Hardware ...**	If the instrument has started correctly so far, there is most probably no fault in the computer; the boot problem presumably results from a defective system file on the hard disk.
Approx. 5 seconds later, the following message is displayed: **OS Loader V4.01....** **Press spacebar now to invoke Hardware Profile/Last Known Good menu**	
followed by (blue background): **Microsoft (R) Windows NT (TM) Version 4.0 (Build 1381 : Service pack 5)** **1 System Processor [256 MBMemory]**	
The version numbers and the memory size depend on the used version.	

Normal action

Subsequent to starting the operation system, the application for the FSQ is loaded in a start-up program. The program start is initiated automatically and generates a window , which displays information on the start-up procedure.

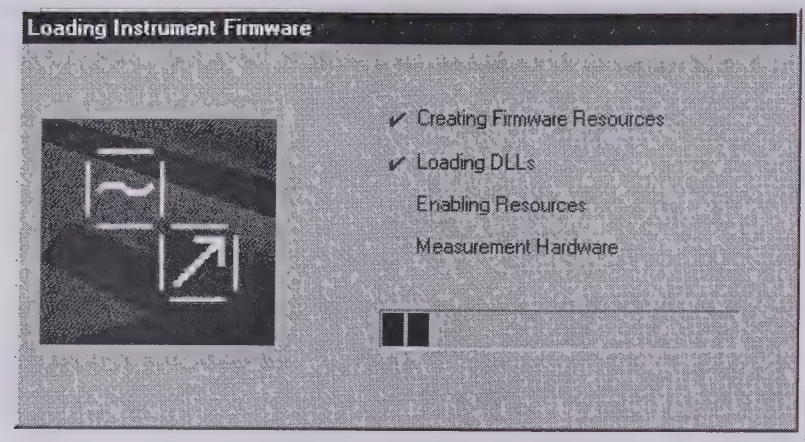
Error and error cause

If the operating system on the hard disk has been destroyed and cannot be loaded correctly, Windows NT reacts by a “Bluescreen”. This bluescreen contains all essential information on the internal states of the computer which are displayed as follows (by way of example):


DSR CTS
*** STOP: 0x0000000A (0x00000000, 0x0000001a, 0x00000008, 0x00000000)
IRQL_NOT_LESS_OR_EQUAL
p4-0300 irql:1f SYSVER:0xf000038e
Dll Base DateStmp - Name
80100000 2e53fe55 - ntoskrl.exe
80010000 2e41884b - Rha154x.sys
8001b000 2e4e7b6b - Scsidisk.sys
fe420000 2e406607 - Floppy.SYS
fe440000 2e406659 - Ea Rec.SYS
fe460000 2e4065f4 - Beep.SYS
fe480000 2e42a4a4 - i8042prt.SYS
fe4a0000 2e40660c - Kbdclass.SYS
fe4b0000 2e53d49d - aki.SYS
fe4e0000 2e406655 - Msfs.SYS
fe510000 2e53f222 - NDIS.SYS
fe550000 2e406697 - TDI.SYS
fe560000 2e5279d9 - nwlnkipx.sys
fe580000 2e494973 - tcpip.sys
fe5b0000 2e5279d3 - netbt.sys
fe5e0000 2e4065b3 - mup.sys
fe630000 2e53f24a - srv.sys
Dll Base DateStmp - Name
80400000 2e53eba6 - hal.dll
80013000 2e4bc29a - SCSIPORT.SYS
80220000 2e53f238 - Ntfs.sys
fe430000 2e406618 - Scsiodrm.SYS
fe450000 2e40660f - Null.SYS
fe470000 2e406634 - Sermouse.SYS
fe490000 2e40660d - Mouclass.SYS
fe4c0000 2e4065e2 - VIDEOPRT.SYS
fe4d0000 2e4065e0 - vga.sys
fe4f0000 2e414f30 - Npfs.SYS
fe500000 2e40719b - elnkii.sys
fe530000 2e47c740 - nbf.sys
fe570000 2e53a89e - nwlnkmb.sys
fe5a0000 2e525db8 - afd.sys
fe5d0000 2e4167f7 - netbios.sys
fe5f0000 2e4f9f51 - rdr.sys
fe660000 2ef16062 - nwlnkspx.sys
Address dword dump Build [1057] - Name
ff541e4c fe5105df fe5105df 00000001 ff640128 fe4a8228 000002fe - NDIS.SYS
ff541e60 fe501368 fe501368 00000246 00004002 00000000 00000000 - elnkii.sys
ff541eb4 fe481509 fe481509 ff6688c8 ff668288 00000000 ff66811f - i8042prt.SYS
ff541ee0 fe481ea8 fe481ea8 fe482078 00000000 ff541f04 8013c58a - i8042prt.SYS
ff541ee4 fe482078 fe482078 00000000 ff541f04 8013c58a ff6688c8 - i8042prt.sys
ff541ef0 8013c58a 8013c58a ff6688c8 ff668040 00405900 00000031 - ntoskrnl.exe
ff541efc 80405900 80405900 00000031 06060606 06060606 06060606 - hal.dll
Restart and set the recovery options in the system control panel
or the /CRASHDEBUG system start option if this message reappears,
contact your system administrator or technical support group.
CRASHDUMP: Initializing miniport driver
CRASHDUMP: Dumping physical memory to disk: 2000
CRASHDUMP: Physical memory dump complete

Windows NT and the instrument firmware must then be updated from the back-up partition (see chapter 4, section "Initial Setup/ Update of the Instrument Firmware").

Normal action



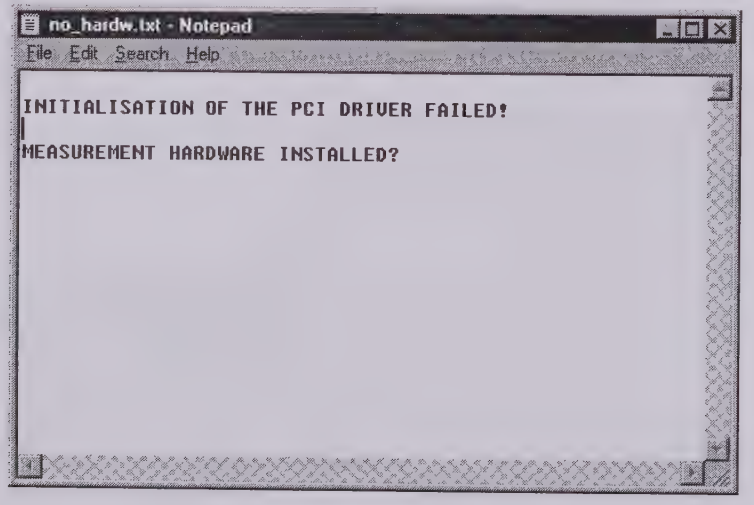
While booting, the wideband detector unit is identified again.

Error and error cause

If a "Bluescreen" is displayed when loading, a cold start may be necessary. Proceed as follows in this case:

- Cold start (keep point key pressed after first beep until display of the selection menu)
- Firmware update from the backup partition, if cold start is not successful (see chapter 4).

If the wideband detector board is not identified, the following message is issued:

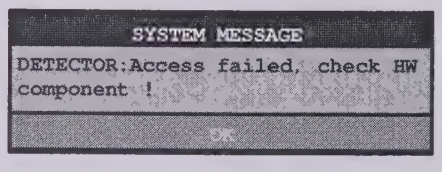


Normal action

When the program has been loaded, the measurement hardware is initialized first. A timer which is controlled by a 32 MHz clock signal is set on the detector board. This test reveals proper functioning of the detector board and the clock oscillator in the FSQ (RF converter).

Error and error cause

If there is an error on the detector board or the clock is missing, the following message is displayed:



After passing the function tests, the analog boards are initialized and the correction data EEPROMs are loaded.

➢ In this case, first check the clock generation in the instrument.

The reference is generated on the synthesizer. This 128 MHz reference is necessary for proper functioning of the detector board.

The following measurements are appropriate to check the reference supply:

Measurement:	Result:
Synthesizer A100, X114: rated value 128 MHz, 0 dBm ⇓	No signal: replace synthesizer.
Synthesizer A100, X114: rated value 32 MHz, 0 dBm	No signal:replace synthesizer.

If no error occurs with the clock generation, booting can be continued by acknowledging the error message using "OK"

If no error message or any other information on the error source is issued during booting, the error can only be determined by replacing the wideband detector unit or the front-module controller.

Troubleshooting - Loading Module EEPROMs

- **Error: Data of modules cannot be read.**

Normal action	Error and error cause
On booting the instrument all calibration data required must be written into the RAM of the computer. The calibration data of a module are either read from the EEPROM (in case of a cold start from EEPROM only) or from the associated binary file. Up to firmware version V.15x the module information is read from the module EEPROM. For each module known to the software a check is first made whether an EEPROM can be read. As of firmware version V1.6x, the module information is read from the module EEPROMs only in case of a cold start. Otherwise only the binary data is read from the hard disk during starting (e.g. motherb.bin).	
If reading at the desired address is not possible, the software assumes that the module is not available.	For modules that must always be available (eg IF filter) an error message will be output: Error reading EEPROM of IF Filter
The calibration data are then read from the file pertaining to the module (e.g. motherb.bin).	If error-free reading of the binary file is not possible either, an error message is output again. Error reading file of IF Filter
If reading at the address of an optional module is not possible, this module is marked as not available in the module array for storage of the module information. If the file pertaining to the non-available module does exist, it is assumed that upon the last successful booting the module was available but has been removed meanwhile. The file with the calibration data of the module is erased. Moreover the data collected during the last calibration are invalid and only saved as a backup copy on the hard disk	If reading at the address of a module is possible but the contents of the data block faulty (eg check sum of header block incorrect), the calibration data of the respective module are read from the associated file. The firmware assumes that the module is available. The information read from the file is entered into the array for storage of the module information. Error reading EEPROM of IF Filter

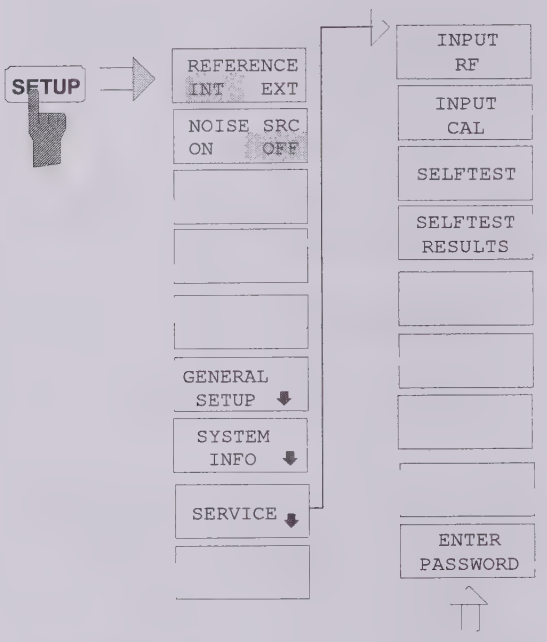
Normal action	Error and error cause
Upon successful reading of the module header from the EEPROM the contents of the module header is compared with the module header of the associated binary file. If the module header can be read from the file and complies with the header read from the EEPROM the assumption is made that the contents of the module EEPROM has already been mapped in the binary file. The calibration data can thus be written from the file to the RAM.	If, however, the associated file cannot be found or if the module header of the EEPROM differs from that of the file, the total EEPROM contents must be written to the RAM and then saved in the binary file. Error finding file of IF Filter
After loading the calibration data from the EEPROMs, the calibration data are loaded from the calibration data files (eg DDC settings for various filters). First the relevant calibration data file is written to the calibration data memory.	If an error occurs upon loading the file into the memory, an error message is output: Error reading file of DDC Filter
After loading the calibration data from the EEPROMs and files, the data collected during the last calibration are loaded from the 'rdf_cal.bin' file into the calibration data memory. This process takes only place if valid calibration data (and the 'rdf_cal.bin' file) are available.	If there are no valid calibration data, the status message "UNCAL " is output informing the user that the instrument is uncalibrated.

Troubleshooting via Selftest

The selftest is provided for identification of instrument errors and tolerance violations which cannot be corrected by self-calibration of the instrument.
All signal paths are connected and the signal is traced via test points. The selftest checks all possible hardware settings which are used for the self-calibration with regard to a sufficient setting range including reserves.

Service Level 1 - Test Following the Entry of a Password
When entering the password, the test result is recorded in detail and in case of a fatal error (such as a failure of the operating voltage), the selftest is *not* aborted.

The selftest can be called in the *SETUP - SERVICE* menu:



➢ Enter the password 894129 with *ENTER PASSWORD*.

➢ Initiate the selftest of the instrument modules using the *SELFTEST* softkey.

While the selftest is running, a message box is displayed, which shows the current test and test result.

➢ Pressing ENTER ABORT aborts the test run.

All modules are tested one by one and the test result (selftest PASSED or FAILED) is output in the message box

The *SELFTEST RESULTS* softkey calls a complete list of all test results.
If an error occurs, a brief description of the failed test, the module concerned, the valid range and the measurement value are displayed.

```
Total Selftest Status: ***FAILED***
Date (dd/mm/yyyy): 10/06/1999 Time: 16:34:47
Runtime: 05:59

Supply voltages detector
test description     min        max        result     state
+6V                  5.88       6.42       6.06       PASSED
+8V                  7.84       8.96       8.56       PASSED
+12V                11.76      12.83      12.42       PASSED
-12V               -11.33     -13.28     -11.85       PASSED
+28V                26.62      29.39      28.34       PASSED
```

Running the Selftest and Error Messages

Overview

The calibration source on the IF-filter module is used as signal source for testing the signal path.

1. Measurement of the operating voltages

   of the power supply
   regulated operating voltages on the detector and IF-filter modules
2. Temperature measurement on the IF-filter board
3. Testing the fourfold D/A converter on the detector
4. Synthesizer test
5. Lock test YIG oscillator and LO level test on RF converter
6. Testing of the signal paths on RF converter, IF filter and detector
7. Test of optional modules

All measurements on the analog boards are independent of the gate arrays on the wideband detector unit, since individual A/D converters are provided for them on the analog boards. The interface section in the FPGA of the wideband detector unit must function properly to read these A/D converters. This is always tested when the instrument is switched on.

The signal path via the gate arrays on the wideband detector unit is tested using a known, analog signal at the input of the A/D converter on the wideband detector unit. The analog test signal is provided by the preceding analog tests.

Since the operating voltages are measured first, it is ensured that the selftest can be performed correctly. If an operating voltage has failed that is not required by the selftest this is correctly signaled in the error list. If, however, all operating voltages are indicated to be faulty, it may well be assumed that the operating voltage for the selftest has failed or the selftest A/D-converter itself is defective.

Testing the Operating Voltages

When an operating voltage fails, the selftest is aborted to avoid subsequent errors.

The test is not aborted after entry of the password. All subsequent errors are then listed in the result record. Errors that have occurred irrespective of the voltage failure can then be detected, still.

The error message indicates the error source (power supply, IF filter, wideband detector unit) and the voltage which has failed.

Normal action	Error and error cause
Power Supply The voltages of the power supply and the –6 V regulator (DC/DC converter from –12 V to –6 V on the motherboard) are measured at the board connector by means of the selftest A/D converter on the wideband detector unit.	
	FATAL ERROR! Power supply: DC FAIL +6V. Selftest aborted.
	➢ If error messages occur, the voltages on the motherboard should be checked. The tolerances given in the column "Tolerance range power supply / voltage regulator" apply in this case. If the voltages are within the tolerance limits, the error must be located in the selftest:
	➢ Replace the wideband detector unit.
Regulated voltages on the boards Wideband detector unit	
	FATAL ERROR! Detector: DC FAIL -5V. Selftest aborted.
	➢ If no faults have been found in the preceding tests, the wideband detector unit has to be replaced.

Channel	Nominal voltage
1	+6V
2	+8V
3	+12V
4	-12V
5	+28V
7	-6V

Channel	Nominal voltage
6	-5V

Temperature Measurement on IF Filter

Normal action

The **temperature** is measured first.

Subsequently the operating voltages are measured.

Channel	Nominal voltage	Expression displayed in the error message
74	- 5 V	UREF-5
77	+2.5 V	UREF+2.5
76	+3.3 V	+3.3 V
73	+5 V	+5 V
72	+10.6 V	+10 V
71	-5 V	-5 V
70	-10,6 V	-10 V
75	+5 V	+5 VR

Error and error cause

WARNING!

IF FILTER: Operating temperature xx °C - out of range

If the temperature does not lie within the permissible range of 0° to 70°C, the warning will be output.

➢ Check the temperature data for plausibility. The fan might be defective or the ventilation slots might be covered.

If the temperature data indicated are not reasonable, e.g. 120° C when the instrument is cold, the temperature sensor or the selftest may be faulty.

If, in the following, the *first* operating voltage (or all operating voltages after entering the password) is measured incorrectly, the selftest will obviously be defective.

➢ The IF filter board must be replaced in any case, if an error message occurs which refers to these operating voltages or the temperature (if not plausible).
The voltage of the temperature sensor is used for temperature compensation of the filters. Thus, a faulty temperature sensor may detune the filters such that subsequent errors are likely to occur.

Checking the 4-fold D/A Converter on the Wideband Detector Unit

Normal action	Error and error cause
Wideband Detector Unit Pretune-DAC Test The 4-fold D/A-converter on the wideband detector unit is checked. One D/A converter controls the frequency-dependant IF gain on the IF filter for frequency response correction. The other ones are provided for options (microwave converter, tracking generator). The first output voltage of the 4-fold D/A converter is measured, thus checking the basic function of the control interface (in DCON gate array), also.	

Channel	Nominal voltage
8	666 mV

FATAL ERROR!
Detector: Pretune DAC FAIL - check DCON and pretune DAC
Selftest aborted.

➢ Replace the wideband detector unit

Testing the Synthesizer

Normal Action		Error and error cause

Chan-nel	Voltage nominal	Expression displayed in the error message
11	- 5 V	-5 V
01	+5 V	+5 V
21	+7 V	+7 V
60	+12 V	+12 V
41	+28 V	+28 V

➢ If there is an error message referring to these operating voltages the synthesizer is to be replaced in any case.

Temperature measurement:
The synthesizer accommodates a temperature sensor for the module temperature and one monitoring the heater of the 128 MHz reference oscillator.

Test channel 71

WARNING!
Synthesizer: Temperature out of range

Test channel 51

WARNING!
Synthesizer: Temperature 128 MHz reference range

➢ In the case of an illegal temperature, it is not sure that the 128 MHz oscillator can be tuned to the correct frequency, since the SC cut crystal used is specified for a temperature of 70 °C.

Reference signals on the synthesizer
The control loops on the synthesizer are checked for the locking status and the set control voltage.

10 MHz OCXO level:
Level detector channel 00.

FATAL ERROR!
10 MHz OCXO defect !

➢ Replace the synthesizer in case of error.

128 / 384 MHz oscillators:
Testing the 128 MHz crystal oscillator and the third LO.

ERROR!
Reference 128 MHz / 3rd LO unlocked !
Reference 128 MHz / 3rd LO out of tuning range !

The instrument may still work properly, but the tuning voltages are almost at the limit or the frequency accuracy is out of tolerance.

➢ Replace/adjust the synthesizer.

Normal action	Error and error cause
Sweep synthesizer: Testing the tuning voltage at the sweep VCO 600 (595) - 620 MHz	ERROR! Sweep synthesizer unlocked ! Sweep synthesizer out of tuning range ! If the sweep VCO fails, the YIG oscillator does not lock or it locks at a wrong frequency and also signals unlock. ➢ Replace synthesizer.
Second local oscillator Testing the tuning voltage at the 4224 MHz oscillator	FATAL ERROR! 2nd LO tuning voltage out of range ! If the second local oscillator fails, it is possible that the YIG oscillator does not lock or it locks at a wrong frequency and also signals unlock. ➢ Replace synthesizer
Calibration signal control voltage: Checking the detector voltage in the level control of the Cal signal	ERROR! Calibration signal error If the control voltage is out of tolerance, the level control loop unlocks and the level becomes inaccurate. In the case of a small level error, the selftest of the signal path is possible. However, the level measuring accuracy will be out of tolerance after instrument calibration. ➢ Replace synthesizer.

Testing the RF Converter

Normal action	Error and error cause
	➢ The RF converter is to be replaced in any case if there is an error message referring to these operating voltages.

Chan-nel	Voltage nominal	Expression displayed in the error message
60	+5 V	+5 V
61	2.5 V	DAC Reference
62	+7 V	+7 V
63	+11 V	+11 V
64	+28 V	+28 V

Temperature measurement:
The RF Converter accommodates a temperature sensor for the module temperature
Test channel 67

WARNING!
RF Converter: Temperature out of range

➢ Check air supply and fan for proper functioning.

Test LO level

The level detectors of the second and third LO are read:

Chan-nel	Oscillator	Expression displayed in the error message
3	LO 3	Level 3rd Local
2	LO 2	Level 2nd Local

- In the case of too low voltage also check the level at the module input in the selftest poll! Setting Center, Zero Span
- + 10 dBm / 384 MHz at X 101
- + 7 dBm / 4224 MHz at X105

If the levels are correct, replace the RF converter. If the levels are not okay (deviation > 3 dB) measure the signals at the synthesizer again and replace the synthesizer, if necessary!

YIG oscillator test:

The YIG oscillator is tuned through the entire frequency band. The pretuning (with upper and lower limit) is also tuned with a small offset from the actual frequency. If the current flowing through the YIG coil and set by the PLL reaches one of these limits, the unlock detector will respond. This is a test both for the pretuning values and for functioning of the PLL.

FATAL ERROR!
YIG Oscillator unlocked !

- Replace the RF converter in the case of error.

Test input mixer

The mixer diodes both rectify part of the LO power. The two voltages can be polled via the selftest channels 0 and 1.

If the two voltages are missing or too low, the LO level is presumably missing, which is why an error message appears:

FATAL ERROR!
1st LO level low or 1st mixer defective !

If the two voltages differ (>20 %), the mixer is asymmetric, i.e. one of the two diodes is damaged.

FATAL ERROR!
1st Mixer symmetry out of tolerance !

In both cases:
Replace RF converter

Testing the Signal Path via the Attenuator

The internal source for the test signal (CAL signal) has already been tested when testing the reference signals. The first and second mixer feature sufficient LO power, i.e. the conversion from the RF to the second IF should therefore work properly.

Normal action	Error and error cause

Signal path via RF attenuator
The measurement is made at the second IF using a logarithmic detector on the RF converter. The 0 dBm test signal is measured with the following attenuator settings:

RF-Att	Coupling	Test
0	DC	Reference measurement
0	AC	AC/DC switch +-5 dB
5	DC	5-dB attenuator +- 5 dB
10	DC	10-dB attenuator +- 5 dB
20	DC	20-dB attenuator +- 5 dB
40	DC	40-dB attenuator +- 10 dB

➢ If there is **no** measured value within the tolerance range, the error is likely to be located in the subsequent signal path. It is not likely that all attenuator stages and the 0-dB position are faulty, therefore the following error message appears.

FATAL ERROR!
Input level RF converter out of tolerance !

➢ Before replacing the RF converter, measure the input level at X108 in any case. For this purpose, the input is connected to the Cal source with 0 dBm and 0 dB attenuator DC coupling. The level should lie at 128 MHz and 0 dBm. Otherwise, check level at X125.

➢ If the level is okay replace the RF converter.

➢ If the signal is not applied at the synthesizer either, replace the synthesizer.

➢ If only individual measurements are out of tolerance, the RF attenuator is defective.

FATAL ERROR!.

RF Attenuator xx dB pad failed !

Caution: *Since a faulty RF attenuator causes many subsequent errors to occur with the IF-filter test, proper functioning of the attenuator is a must.*

Signal Paths on the IF Filter Board

Normal action	Error and error cause
Input level of IF filter / calibration amplifier (CAL-Amps 1 + 2)	FATAL ERROR! IF Board: IF input level / CALAMP Selftest aborted Possible error causes: • Signal path interrupted in the RF converter. • Erroneous EEPROM data in the RF converter leading to incorrect setting of CAL_Amp1. • CAL_Amp1 or 2 faulty. Troubleshooting ➢ Check the level applied at X132 with 0 dBm mixer level: Nominal –3 dBm, production tolerance ± 3 dB, max. permissible ± 4.5 dB; ➢ Replace the RF converter if the deviation exceeds this value.

Normal action	Error and error cause
	If the level lies within the tolerance, a defective CAL_Amp may have caused the error. The setting ranges of the CAL_Amps are tested during the selftest, later. The selftest is not interrupted after entry of a password. ➢ Note whether the result file contains any error messages concerning the CAL_Amps. If there is no CAL_Amp error, the CAL_Amps will be set incorrectly. The EEPROM data in the RF converter are obviously incorrect.
LC filter I and XTAL filter The level measurement is performed with wide and narrow bandwidths of the LC filter. Subsequently, an additional measurement is made via the crystal filter. If the LC filter does not work properly, the measurement of the crystal filter is not performed.	ERROR! IF board: LC Filter-1/2 wide XTAL Filter not tested ERROR! IF board: LC Filter-1/2 narrow XTAL Filter not tested ERROR! IF board: XTAL Filter ➢ The IF filter board must be replaced in all cases.

Normal action	Error and error cause
StepGain (IF amplifier) The 10-dB Step Gain (Step Gain Coarse) and the 0.1 dB Step Gain (Step Gain Fine) are tested. The input level is attenuated in steps of 10 dB by the RF attenuator and simultaneously amplified by means of the StepGain by the same amount. The level detector C checks to ±6 dB (user) or ±4 dB (service level 1).	FATAL ERROR! IF board: Step Gain Fine Selftest aborted ➢ Test with Step Gain Coarse by-passed (0 dB) and Step Gain Fine set to 0 dB If an error occurs, Step Gain Fine does not work correctly or the signal path is interrupted. ➢ Replace the IF-filter board. ERROR! IF board: Step Gain Coarse ➢ Testing the amplifier stages. ERROR! IF board: Step Gain Fine ➢ Testing the amplifier stages. ***Attention:*** *If the RF attenuator test has already caused an error message, Step Gain cannot be tested and an error message must be ignored!* ➢ If the RF attenuator test passed without any error, Step Gain is defective. ➢ Replace the IF-filter board. However, the selftest can be continued, since it does not require the IF gain.

Signal Paths on the Wideband Detector Unit

Normal action	Error and error cause
Various settings of the wideband detector unit are checked via the normal display function, i.e. FFT mode, digital filters and analog filters. Possible error messages:	ERROR! Detector Board: FFT Detector Board: FIR Detector Board: Video

OPTION: I/Q Baseband Input Board FSQ-B71

Baseband Signal Input on Wideband Detector Board

Normal action	Error and error cause
Baseband input X144 (I channel) is checked for continuity. Baseband input X145 (Q channel) is checked for continuity. To this end the baseband input 2 board applies a DC voltage >1 V to inputs X144 and X145. The voltage is typically higher than the measurement range of the A/D converter so that the result corresponds to the full-scale value 1.42 V. Compliance with >0.6 V is checked. For a second measurement in each channel, the input is switched off. For the I channel, this is done by switching to the IF path; for the Q channel by switching to GND. The typical value measured is 0 V. Compliance with <0.2 V is checked.	See under SELFTEST RESULTS: detector board: baseband input path tests I channel IF FAILED and / or Q channel GND FAILED Possible error sources: • Input switch or A/D converter on the wideband detector board defective I channel I FAILED and / or Q channel Q FAILED Possible error sources: • Input switch or A/D converter on the wideband detector board defective.

- The baseband input 2 board does not provide the DC voltage required for the selftest.

Troubleshooting:

➢ Disconnect cable from X144 and X145 and apply a DC voltage of approx. 1 V to the baseband inputs X144 and X145. Repeat selftest

➢ If all four "detector board - baseband input path tests" are PASSED, the baseband input 2 board is faulty.

➢ If the "detector board - baseband input path tests" (or some of them) are still FAILED, the wideband detector board must be replaced.

Note: Because of the disconnected cables, all subsequent tests on the baseband board will be FAILED.

Baseband Input Board

Normal action	Error and error cause
Signal path All switchable signal paths will be checked for compliance with a level tolerance of ±10%. These are: I channel, high I channel, low Q channel, high Q channel, low In each of these four paths, the 0 dB range, the two -5/-10 dB attenuators and the three +5/+10/+15 dB amplifiers are checked. An additional measurement is performed in the I and Q paths with the filter switched on. If an error is detected in the 0 dB range, all other amplifier/attenuator stages and the filter are not checked as they would inevitably produce a FAILED.	See under SELFTEST RESULTS: baseband board: signal path tests I/Q path high/low x dB FAILED and / or I/Q path filter FAILED • Switch or amplifier on the baseband input 2 board. • Special case: I/Q path high, 0 dB, FAILED If this error occurs, all other tests in the respective channel are skipped. The cause may also be a defective cable to the

wideband detector board: W57 (I channel) or W58 (Q channel). First check the cables or replace them for a test. If the cables are OK, replace the baseband input 2 board.

Other components

Dither
The peak-peak voltage of each channel (I and Q) is measured first with and then without dither signal (internal noise only).

DC offset DAC
Function and setting range of the two DACs are checked.
(The DACs are required to compensate for the I/Q offset.)

Pulse source
Check level of pulse source.
(The pulse source is required to determine the frequency response correction.)

See under SELFTEST RESULTS:
baseband board: components

I/Q path dither	FAILED
and / or	
I/Q DC offset DAC	FAILED
and / or	
pulse source	FAILED

- Failure of components (dither, DC offset, DAC, pulse source) on the baseband input 2 board.

I/Q path noise	FAILED

- Strong noise on the baseband input 2 board (e.g. because the amplifier is defective) or on the wideband detector module (e.g. stuck bit).

Troubleshooting:

➢ Disconnect cables from X144 and X145 on the wideband detector board and terminate the inputs X144 and X145 with 50 Ω or short-circuit them. Repeat selftest, with password, so that the test is not interrupted.

➢ Observe only the measured I/Q path **noise**:
If a PASSED is obtained → replace the baseband input 2.
If a FAILED is obtained → replace the wideband detector board.

Troubleshooting RF Converter 1

Depending on the kind of error, a few measurements should be performed on the RF converter before the module is replaced:

- **IP3 too high**
- **Signal level too low**
- **LO feedthrough too high**
- **Spurious signals**

These errors may be caused by a defective input mixer. Since this mixer is directly connected to the input connector, it may be easily destroyed by the user.

A defective mixer can be recognized from a very high display of > -10 dBm at the frequency 0 Hz with 0-dB input attenuation.

Action	Error and error cause
Measure with diode tester at X101: rated value: approx. 0.6 V voltage in the forward and reverse directions with a current of 1 mA.	Different values in both directions, high-impedance or very low-impedance: mixer defective : replace RF converter

- **Signal missing or displayed with incorrect frequency**

If the signal is missing or the instrument signals "LOUNL", the conditioning of the 1st LO is probably not correct. The function of this oscillator requires both, the EEPROM data and the reference frequency of the second module.

Action	Error cause/remedy
Measure function of the 1st LO in zero span. check signal at X107: rated value: 4628.4.4 MHz above the current input frequency (between 0 Hz and 3.6 GHz) and the signal level is approx. –5 dBm.	The frequency is considerably higher or lower or the signal is not stable replace RF converter

Troubleshooting - Wideband Detector Unit

The extensive selftest will detect most of the faults that may occur on the wideband detector unit.

Selftests performed

- complete signal path for analog filters, digital filters and FFT
- detectors
- PCI interface, data transfer from and to main processor
- signal processing chain (resampler, wideband DDC, RAM, DSP)
- clock synthesizer
- Pretune DAC
- frequency and time sweep
- supply voltages

Any "failed" in the test results of the detector board indicates a fault in this unit, provided the tests of the preceding boards (RF converter, synthesizer, IF filter) have all been passed. For example, the tests of the detector board signal path rely on a correct IF or video input signal.

Part of the signal path is tested only functionally. Performance testing is restricted from the analog input (IF/Video) via the A/D converter to the correction RAM. For example, a blocked bit (except one of the most significant ones) cannot be detected, as there is no test pattern available from ADC.

If the selftest has been passed but the instrument shows unexpected response in the spectrum display such as spikes, strong noise, pumping noise floor, spurious, stepped curves and so on, some additional tests should be performed to prove that the fault is actually in the detector unit.

To ensure that the detector board receives an error-free signal, a signal generator must be used to substitute the IF/video signal.

Test Setup

Connect signal generator (50 Ω output impedance) to X149 of the detector board.

Video Path, Differential Linearity Test

This is a sensitive test for blocked bits.

Signal generator settings

Frequency	1 kHz
Level	-1.7 dBm

FSQ settings

Preset	
Zero Span	
Sweep time	300 µs
AMPT	Range Linear
CAL	Cal Corr Off
Trigger	Video

Expected display

Continuous sinewave-like trace without significant steps
(very small steps are due to noise and pixel resolution)

Why use a linear display? The instrument expects a logarithmic signal at the ADC input. In case of a linear display, the signal is therefore log/lin converted. In the test case, a linear signal is used instead at the ADC input. The log/lin conversion then considerably magnifies differential errors at high levels, yet the whole level range is displayed.

Fig. 3-15 shows the trace of an error-free unit.
In the trace shown in Fig. 3-16, there is an error at the seventh highest bit (differential error = 1/128 of range). Due to the log/lin conversion the effect is extremely magnified at higher levels.

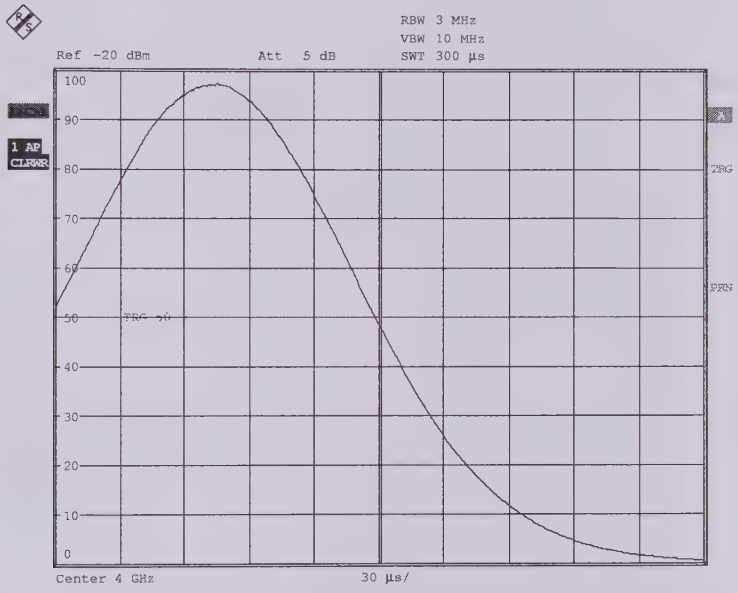


Fig. 3-15 Video path differential linearity test, error-free unit

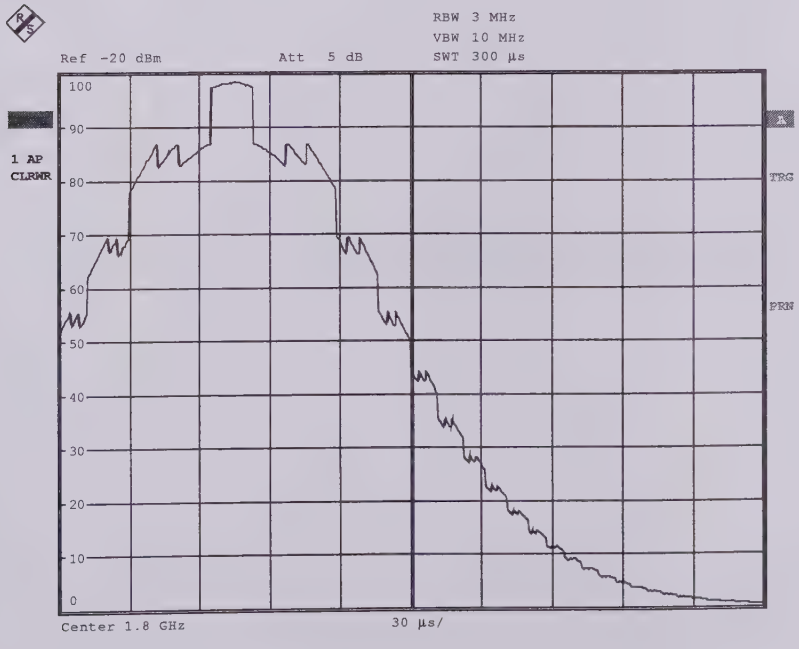


Fig. 3-16 Video path differential linearity test, faulty unit (blocked bit).

FFT Path Performance Test

FSQ settings
- Preset
- Span 50 kHz
- RBW 100 Hz
- Filter Type FFT
- AMPT: Log Range Manual 120 dB
- CAL: Cal Corr Off

Noise floor

Signal generator setting
- Level OFF (50 Ω termination alternatively)

Expected display

Noise at the bottom line of the display (see Fig. 3-17).

Possible errors:
- Higher noise (more than 10 dB compared to Fig. 3-17)
- Higher noise in single sweeps (needs some observation time)

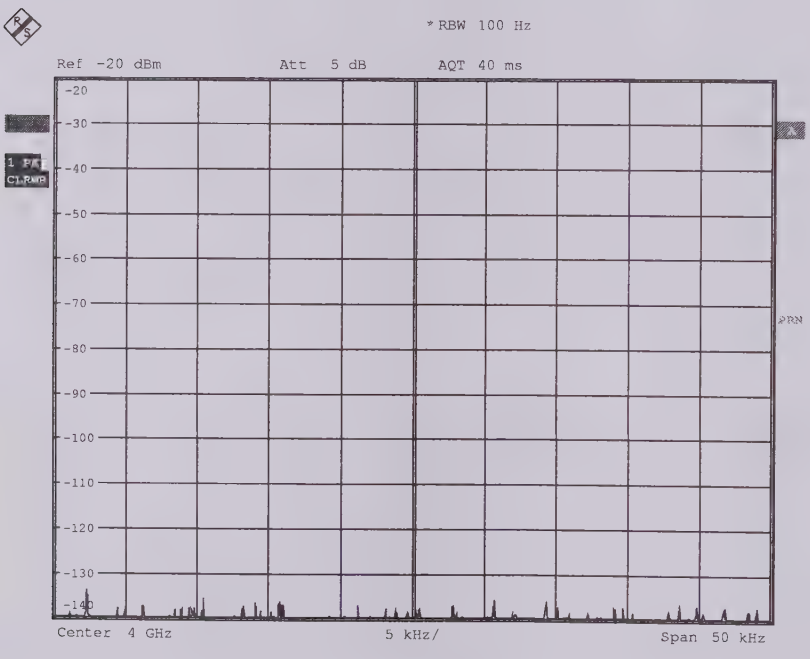


Fig. 3-17 FFT test, noise floor, error-free unit

Full Scale Test

Signal generator settings
Frequency 20.4 MHz
Level -2.9 dBm

FSQ setting
Marker to peak

Expected display

Spectrum of clean CW signal at center frequency (see Fig. 3-18) , level -20 dBm ±2 dB (marker readout)

Possible errors:
level out of tolerance
distorted spectrum
spurious
extreme noise

Note: *The signal generator sets the limits for spurious and phase noise!*

Fig. 3-18 is derived from a high-quality signal generator (R&S SMHU).

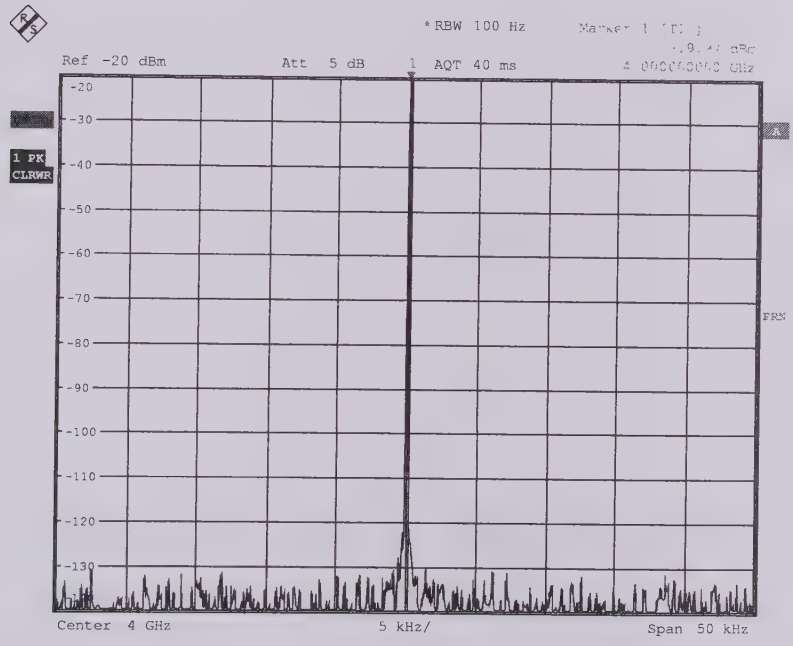


Fig. 3-18 Full-scale test, error-free unit

Linearity test

Signal generator settings
Frequency 20.4 MHz
Level -2.9 dBm

FSQ settings
Marker to peak, reference fixed

Signal generator settings
Frequency 20.4 MHz
Level -12.9 dBm to –52.9 dBm in 10 dB steps

Delta marker readout

Signal generator	-12.9 dBm	-22.9 dBm	-32.9 dBm	-42.9 dBm	-52.9 dBm
Delta marker	-10 ±0.5 dB	-20 ±0.5 dB	-30 ±0.5 dB	-40 ±0.5 dB	-50 ±1 dB

Note: *Use step attenuator if the signal generator's level linearity is worse than 0.2 dB.*

Phase noise test

Signal generator setting
Frequency 20.4 MHz
Level -42.9 dBm

Expected display

Spectrum of clean CW signal at center frequency, level approx. -60 dBm.
The noise level must not be higher than the noise level measured in the noise floor test (see Fig. 3-19)

Presumption: Signal generator phase noise ≤-100 dBc / Hz at >1 kHz offset

Possible errors:
phase noise higher than thermal noise floor (example: Fig. 3-19)
Distorted spectrum
Spurious

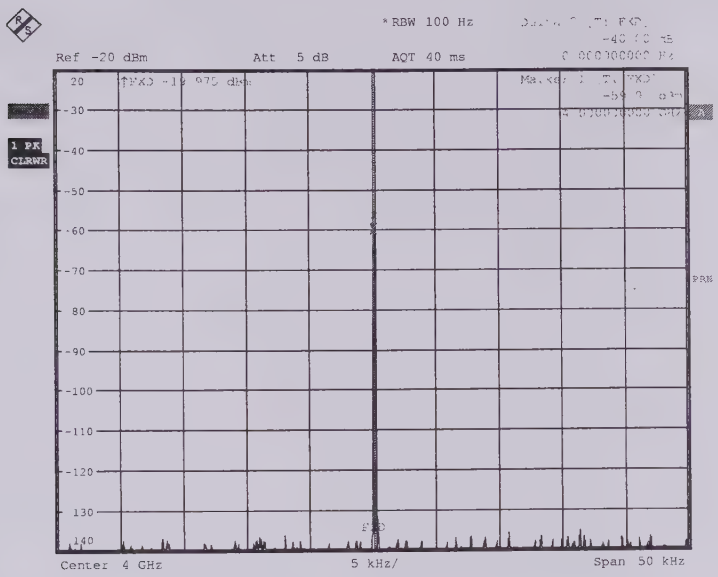


Fig. 3-19 Phase noise test, error-free unit

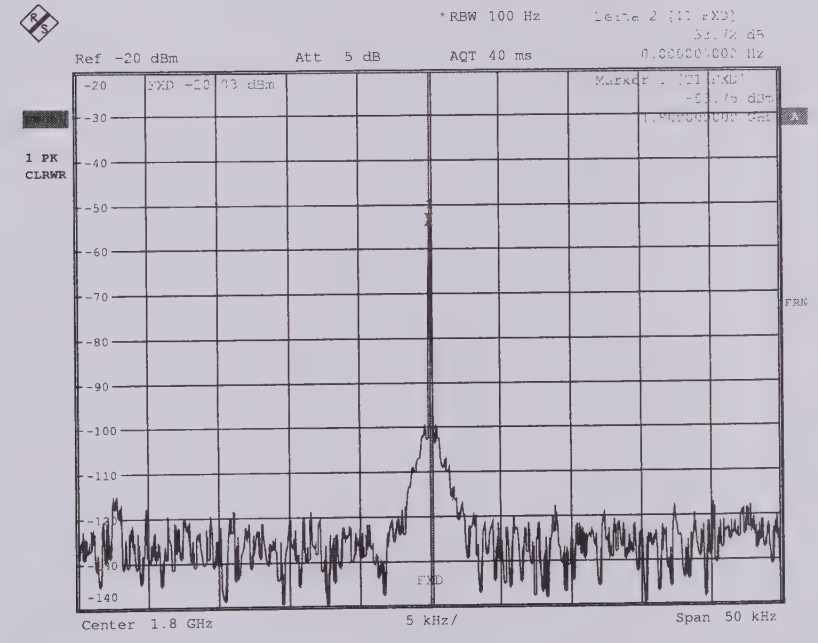


Fig. 3-20 Phase noise test, faulty unit (high phase noise)

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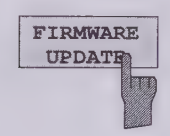
4 Software Update / Installing Options

This chapter contains information on Software-Update and Installing Options to the . Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

Installation of new Software

The installation of a new firmware version can be performed using the built-in diskette drive. The firmware update kit contains several diskettes.
The installation program is called up in the *SETUP* menu.

SETUP sidemenu:



The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

IE/IEEE-bus command: --

Performing the update:

Insert diskette 1 into the drive.
Call *SETUP* side menu *[**SETUP**][**NEXT**]*

Start update *[FIRMWARE UPDATE]*

The *RESTORE FIRMWARE* softkey restores the previous firmware version

IEC/IEEE-bus command: --

Installing the Options

The following options are available with the :

Option OCXO	FSU-B4	1129.6740.02
Option External Generator Control	FSU-B10	1129.7246.02
Option Flash Disk	FSQ-B20	1155.1606.04
Option Elektronic Attenuator	FSU-B25	1129.7746.02

For retrofitting, please note the mounting instructions enclosed with the options.
These mounting instructions can be filed at this place in the service manual and are thus easily available whenever they are required.

Caution!

Disconnect the instrument from the mains before opening the casing. Also note the safety instructions at the beginning of this manual.

The components used in the instrument are sensitive to electrostatic discharges which is why they are to be dealt with according to the ESD regulations.

When installing hardware options note the following:

- Switch off instrument and pull the mains plug.
- Unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- After installing the option replace the tube and fasten the rear panel feet again.

Caution!

When replacing the tube take care not to damage or pull off cables.

- Switch on .
- Install additional software, if supplied, according to the instructions enclosed with the option.
- If an adjustment is required for this option, the appropriate hints are to be found in the installation instructions for the option.

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5 Documents

This chapter provides information on the ordering of spare parts and contains the spare part list and the documents for the complete unit.

Shipping of Instrument and Ordering of Spare Parts

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

We require the following information in order to answer your inquiry fast and correctly and to decide whether the warranty still applies for your instrument:

- Instrument model
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Shipping of Instrument

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection

➢ Repack the instrument as it was originally packed when transporting or shipping. The two protective caps for the front and rear panels prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

➢ If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Shipping of a Module

When shipping a module, then, also be also careful to provide for sufficient mechanical and antistatical protection

➢ Ship the module in a sturdy, padded box.

➢ Wrap the board into antistatic foil.
If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed packaging is conductive.
Exception: If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

To deliver replacement parts promptly and correctly we need the following indications:

- Stock number (see component lists in this chapter)
- Designation
- Component number according to component list
- Number of pieces
- Instrument type the replacement part belongs to
- Contact person for possible questions

The stock numbers necessary for ordering replacement parts and modules as well as power cables can be found further down.

Refurbished Modules

Refurbished modules are an economic alternative for original modules. It should be kept in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use but they are electrically and mechanically equivalent to new modules.

To find out which refurbished modules are available, please refer to your Rohde & Schwarz representative (or to the central service division, Rohde & Schwarz Munich).

Taking back Defective Replaced Modules

Defective modules of the replacement program which can be repaired are taken back within **3 months** after delivery of the replaced module. A repurchasing value is credited.

Excluded are parts which can not be repaired, e.g. PCBs that are burnt, broken or damaged by repair attempts, incomplete modules, parts which are heavily damaged mechanically.

The defective parts must be sent back with a **returned accompanying document** containing the following information:

- Stock number, serial number and designation of the dismounted part,
- **Precise** description of the error,
- Stock number, serial number and designation of the instrument the part was dismounted from,
- Date of dismounting,
- Name of the technician who exchanged the part.

A returned accompanying document is provided with each replacement module.

Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.

Important Note!

When replacing a module please note the safety instructions and the repair instructions given in chapter 3 and at the beginning of this service manual

When shipping a module be careful to provide for sufficient mechanical and antistatical protection.

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

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Spare Part List

Mechanical Drawings

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List of parts including spare parts

The is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 426,7 x 176,5 x 517

Rackmount: 4E 1/1 T450

Accessories: 19"-Adapter ZZA-411, Stock no. 1096.3283.00

Note: *The recommended spare parts are marked x in the like column.*

Table 5-2 List of all part and spare parts

Position	Designation	Stock No.	Number	Electri-cal designa-tion	Recommended Spare Parts
Document 1155.5001.01 (FSQ-instrument)					
10	Basic Unit	1129.9032.04	1 S		
15	Fan	1091.1001.00	1 S	E1	x
17	Speaker	1129.9332.00	1 S	B1	x
20	Attenuator.(6-STUFIG) FSU3/8	1137.0599.02	1 S	A40	x
25	Attenuator FSU26	1046.5130.02	1 S	A40	x
26	Insolating plate	1129.9690.00	1 S		
27	DIN965-M2,5X6-A4-PA	0852.3614.00	4 S		
28	DIN6900-M2,5X6 -A2	0071.5040.00	3 S		
30	Ribbon cable W40	1130.2515.00	1 S	W40	
40	DIN6900-M2,5X6 -A2	0071.5040.00	2 S		
43	VOL/PHONES BOARD	1093.7094.02	1 S	A191	x
44	HOLDING BRACKET AF-OUT	1129.9326.00	1 S		
45	DIN6900-M2,5X6 -A2	0071.5040.00	1 S		
46	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
48	Rotary knob 13 ACHS-RD4T-GR	0852.1211.00	1 S		
49	Ring for rotary knob	0852.1228.00	1 S		
50	KEY-PROBE	1130.2996.02	1S	A80	x
55	DIN965-M2,5X6-A4-PA	0852.3614.00	4 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
61	Subassembly plate II	1129.9678.00	1 S		
70	DIN965-M2,5X6-A4-PA	0852.3614.00	4 S		
81	Adhesive foil 30X20 SW	1093.9051.00	6 S		
83	Adhesive foil 30X20 SW	1093.9051.00	1S		
91	Cover RD15,9	0009.9200.00	2 S		
100	RF CONVERTER	1130.4001.02	1 S	A100	x
105	SYNTHESIZER	1130.2096.03	1 S	A110	x
110	WIDEBAND DETECTOR UNIT	1130.3086.03	1 S	A140	x
120	IF-FILTER	1130.2296.03	1 S	A130	x
130	CONVERTER UNIT(8 GHZ)	1130.2544.03	1 S	A160	x
135	Angle bracket MW converter	1129.9384.00	1 S		
136	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
140	MW-CONVERTER UNIT 26,5 GHz	1130.3240.27	1 S	A160	x
160	Air cover	1129.9355.00	2 S		
161	Air cover	1129.9355.00	1 S		
170	Rear panel	1129.9149.00	1 S		
180	DIN6900-M2,5X6 -A2	0071.5040.00	6 S		
190	Cover 9-pin SUB-D	1093.8990.00	1 S		
200	Cover 25-pin SUB-D	1093.9000.00	2 S		
210	Cover RD11,1/9,9	0009.9217.00	5 S		
220	Cover f. LAN-connector	0852.0467.00	2 S		
225	Cover f. IEC-BUS	0852.0450.00	1 S		
230	ADAPTER	1093.9122.00	1 S		
231	CABLE 2xRJ45	1066.1899.00	1 S		
240	Instrument top cover	1129.9261.00	1 S		
250	DIN6900-M2,5X6 -A2	0071.5040.00	3 S		
260	DIN965-M2,5X6-A4-PA	0852.3614.00	10 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
270	Printed front panel 3.6GHz	1155.5501.00	1 S		
280	Printed front panel 8GHZ	1155.5518.00	1 S		
290	Printed front panel 26.5GHZ	1155.5524.00	1 S		
295	RF-cable W1 8GHZ	1129.9503.00	1 S	W1	x
315	TESTPORT GEH. ADAPTER	1021.0493.00	1 S	X1	x
316	RF-CABLE W1 26.5GHZ	1129.9555.00	1 S	W1	x
330	Assembly plate	1093.4750.00	1 S		
340	Assembly plate	1093.4772.00	1 S		
350	DIN965-M2,5X6-A4-PA	0852.3614.0	4 S		
410	BW2-HOUSING 4E1/1T450 FSU	1129.9410.00	1 S		
420	BW 2 - front handle 4U	1096.1480.00	2 S		
430	Screw M4X14	1096.4909.00	4 S		
440	BW2-instrument foot	1096.2506.00	4 S		
442	SUPPORTING FOOT	1096.2529.00	2 S		
445	BW2-lateral handle.T450	1096.2670.00	2 S		
450	BW2-rear panel foot 50MM	1096.2493.00	4 S		
455	BW2-foil f. rear panel foot	1096.2435.00	1 S		
Document 1129.9032.01 (Basic unit)					
500	Instrument frame	1129.9090.00	1 S		
511	MOTHERBOARD	1130.1760.02	1 S	A10	x
520	DIN6900-M2,5X6 -A2	0071.5040.00	7 S		
530	Locking bolt M3	0009.6501.00	4 S		
540	Locking bolt H=4,5-40	1093.9180.00	2 S		
550	Power supply unit 230W	1091.2320.00	1 S	A20	x
560	DIN6900-M2,5X6 -A2	0071.5040.00	10 S		
571	FMR 6/5	1091.2520.00	1 S	A90	x
581	BIOS to FMR6	1155.5482.00	1 S		

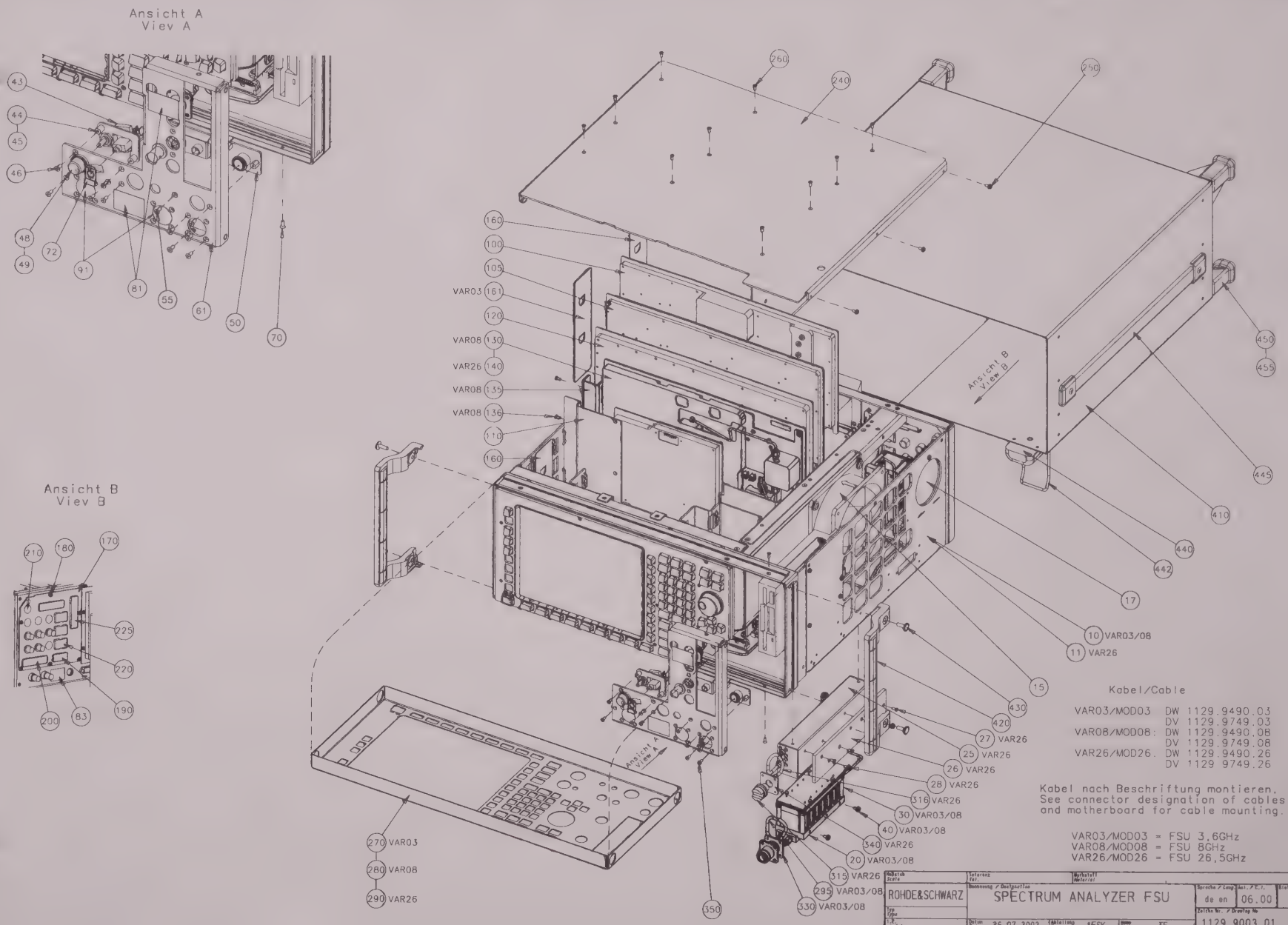
Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
590	DIN6900-M2,5X6 -A2	0071.5040.00	10 S		
601	Display unit	1093.4708.05	1 S		
610	DIN965-M2,5X6-A4-PA	0852.3614.00	4 S		
621	Keyboard frame	1093.5127.00	1 S		
631	Keyboard mat	1093.5133.00	1 S	A16	x
641	Keyboard membrane	1093.5140.00	1 S	A15	x
650	Rotary knob RD28 ACHS-RD6	0852.1086.00	1 S		
660	DIN965-M2X6-A4-PA	0852.3520.00	10 S		
670	3,5" FLOPPY DRIVE STD.	0048.4935.00	1 S	A30	x
680	Floppy bracket	1129.9161.00	1 S		
690	W300 CABLE FLOPPY DATA	1129.9726.00	1 S	W300	
691	CABLE FLOPPY POWER	1129.9732.00	1 S	W301	
700	DIN6900-M2,5X6 -A2	0071.5040.00	3 S		
702	DIN6900-M3,0X6 -A2	0071.6847.00	3 S		
710	Harddisk with firmware FSQ	1155.5460.00.	1 S	A60	x
720	Ribbon cable	1093.5156.00	1 S	W29	
730	Disk bracket	1093.4837.00	1 S		
740	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
750	DIN965-M3X5-A4-PA	0396.8023.00	4 S		
776	LITHIUM-BATTERIE CR2032	0858.2049.00	1 S		
Document 1093.4708.01 Page 4 (Display unit)					
805	Assembly tray	1129.9426.00	1 S		
810	Shielded filter plate	1091.2014.00	1 S		x
820	RF spring (177)	1069.3011.00	2 S		
830	RF spring (137)	1069.3105.00	2 S		
840	Plate holder	0852.0844.00	4 S		
850	DIN965-M2X4-A4-PA	0852.3508.00	4 S		
865	Dust sealing	1129.9449.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
871	VNR-08C351-INVERTER	0048.8760.00	1 S	T10	x
892	DIN6900-M2,5X6 -A2	0071.5040.00	2 S		
907	Converter cable L=310	1091.2650.00	1 S	W100	x
910	Spin wheel	0852.1170.00	1 S	B10	x
915	Screw for plastic material 1.8x4,4	1066.2066.00	3 S		
921	800X600X3 TFT DISPLAY	0048.8599.00	1 S	A70	x
930	DIN6900-M2,5X6 -A2	0071.5040.00	4 S		
932	Space	1129.9432.00	4 S		
934	DIN965-M2,5X5-A4-PA	0852.3608.00	4 S		
948	Display cable TOSHIBA	1091.2666.00	1 S	W70	x
949	Display connector	1091.2637.00	1 S	W71	x
950	DIN6900-M2,5X6 -A2	0071.5040.00	2 S		
Document 1144.9017.00 (Option FSU-B4 1144.9000.02)					
1100	OCXO	1093.7871.03	1 S	A200	x
1120	RF-cable W21	1129.9926.00	1 S	W21	
Document 1144.9300.00 (Option FSU-B25 1144.9298.02)					
1400	ATTENUATOR (PARTLY ELECTRICAL)	1108.7230.02	1 S	A50	x
1410	Ribbon cable 10 POL	1129.7823.00	1 S		
1420	RF-CABLE W 27	1144.9330.00	1 S		
1425	RF-CABLE W27 (26,5 GHz)	1144.9323.00	1 S		
1430	RF-CABLE W28 (RF-CON)	1144.9346.00	1 S		
1440	RF-CABLE W28 (MW-CON)	1144.9352.00	1 S		
1460	DIN6900-M2,5X8 -A2	0071.5705.00	4 S		
Documnet 1129.7298.00 Page 2 (Option FSP-B10 1129.7246.02)					
1600	EXT. GEN. CONTROL	1093.8590.02	1 S	A210	x
1610	IEC-BUS Cable W21	1129.7252.00	1 S	W21	x
1612	DIN125-A3,2-A4	0082.4670.00	2 S		
1614	DIN137-A3-A2	0005.0296.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
1620	Aux control cable W22	1129.7269.00	1 S	W22	x
1622	Locking bolt M3	0009.6501.00	2 S		
1624	DIN137-A3-A2	0005.0296.00	2 S		
1626	DIN934-M3-A4	0016.4398.00	2 S		
Document 1142.9090.00 (Option FSU-B9 Tracking Generator 1142.8994.02)					
1800	Tracking Generator	1130.3605.02	1 S	A170	x
1810	RF-CABLE W41	1142.9003.00	1 S	W41	
1820	RF-CABLE W42 (RF-Con)	1142.9010.00	1 S	W42	
1830	RF-CABLE W42 (8GHz)	1142.9026.00	1 S	W42	
1840	RF-CABLE W43	1142.9032.00	1 S	W43	
1850	RF-CABLE W44	1142.9049.00	1 S	W44	
1860	RF-CABLE W45	1142.9055.00	1 S	W45	
1870	RF-CABLE W46	1142.9061.00	1 S	W46	
1880	RF-CABLE W47	1142.9078.00	1 S	W47	
1890	RF-CABLE W48	1142.9084.00	1 S	W48	
1895	ADAPTOR	0343.0257.00	1 S	X2	x
1900	MOUNTING PLATE	1093.4750.00	1 S		
1910	DIN965-M2,5X6-A4-PA	0852.3614.00	4 S		
1920	LABEL FSU-B9 FRONT	1142.9132.00	1 S		
1930	LABEL FSU-B9 REAR	1142.9126.00	1 S		
Document 1130.2544.01 (Converter Unit 8GHz)					
2000	8 GHZ CONVERTER	1130.2550.02	1 S	A160	x
2015	YIG-UNIT 8GHz (MICRO LAMBDA)	1130.2944.04	1 S	A161	x
2020	YIG-UNIT 8GHz (FILTRONIC)	1130.2944.05	1 S	A161	x
2025	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
2030	DIPLEXER 8GHZ	1132.6501.02	1 S	A162	x
2035	DIN6900-M2,5X5 -A2	0071.6830.00	4 S		
2040	RELAY UNIT 8GHz	1130.2815.02	1 S	A164	

Position	Designation	Stock No.	Number	Electrical designation	Recom-mended Spare Parts
2045	RELAY HOLDER	1130.2644.00	1 S		
2050	DIN7985-M3x40 -A2	0071.7714.00	2 S		
Document 1130.2815.01 (RELAY UNIT 8 GHz)					
2060	RELAY SMA 12V	1130.1254.00	2 S	K1 / K2	x
2065	RELAY CABLE	1130.2838.00	1 S		
2070	RF CABLE W1 RELAY	1130.2844.00	1 S		
2075	RF CABLE W4 RELAY	1130.2873.00	1 S		
2080	RF CABLE W5 RELAY	1130.2880.00	1 S		
Document 1130.3240.01 Blatt 1 (MW-Converter Unit 26.5 GHz)					
2100	26 GHz CONVERTER	1130.3257.02	1 S	A160	x
2105	DIPLEXER26	1151.3010.02	1 S	A161	x
2110	DIN6900-M2,5X6 -A2	0071.5040.00	4 S		
2115	YIG UNIT (MICRO LAMBDA)	1130.3311.26	1 S	A162	x
2120	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
2125	EXTENDER 26	1132.8504.02	1 S	A163	x
2130	DIN6900-M2,5X6 -A2	0071.5040.00	7 S		
2135	RF-CABLE W3	1130.3340.00	1 S		
2140	RF-CABLE W4	1130.3357.00	1 S		
2145	RF-CABLE W5	1130.3363.00	1 S		
2150	HOLDER LO CABLE	1130.3292.00	1 S		
2155	DIN6900-M2,5X6 -A2	0071.5040.00	2 S		
2160	Cover B side	1130.3270.00	1 S		
2165	Cover A side	1130.3286.00	1 S		
2170	RELAY UNIT 26,5 GHz	1130.3405.02	1 S	A164	
2180	DIN965-M2,5x6-A4-PA	0852.3614.00	2 S		
2190	CLAMP	0080.3653.00	1 S		
2195	DIN6900-M2,5X6 -A2	0071.5040.00	1 S		
Document 1130.3405.01 (RELAY UNIT 26,5 GHz)					
2300	RELAY SMA 12V	1137.4788.00	2 S	K1 / K2	x
2305	RELAY CABLE	1130.2838.00	1 S		
2310	RELAY HOLDER	1130.3392.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2315	DIN7985-M2,5x30-A4	0455.5966.00	2 S		
2320	RELAY SHIELDING	1130.3470.00	1 S		
2325	RF CABLE W1	1130.3428.00	1 S		
2330	RF CABLE W2	1130.3434.00	1 S		
2335	RF CABLE W6	1130.3440.00	1 S		
2340	RF CABLE W7	1130.3457.00	1 S		
2345	RF CABLE W8	1130.3463.00	1 S		
Document 1142.9361.00 (Option FSU-B12 Tracking Attenuator 1142.9349.02)					
2400	STEP ATTENUATOR (FSU-B12)	1067.8380.04	1 S	A171	x
2400	ATTENUATOR HOLDER	1129.9455.00	1 S		
2415	DIN6900-M3x8-A2	0071.6853.00	2 S		
2420	DIN6900-M2,5x6-A2	0071.5040.00	3 S		
2430	RF CABLE W41	1142.9378.00	1 S	W41	
2440	RF CABLE W49	1142.9384.00	1 S	W49	
2445	ADAPTER CABLE	1142.9390.00	1 S		
Document 1157.0136.00 (Option FSQ-B71 Baseband Input 1157.0113.02)					
2700	BASEBAND INPUT 1	1130.3770.02	1 S	A270	x
2710	BASEBAND INPUT 2	1130.3686.02	1 S	A260	x
2720	RF CABLE W51	1157.0142.00	1 S	W51	
2725	RF CABLE W52	1157.0159.00	1 S	W52	
2730	RF CABLE W53	1157.0165.00	1 S	W53	
2735	RF CABLE W54	1157.0171.00	1 S	W54	
2740	RF CABLE W55	1157.0188.00	1 S	W55	
2745	RF CABLE W56	1157.0194.00	1 S	W56	
2750	RF CABLE W57	1157.0207.00	1 S	W57	
2755	RF CABLE W58	1157.0213.00	1 S	W58	
2760	DIN965-M2,5x6-A4-PA	0852.3614.00	3 S		
2780	MOTHERBOARD LABEL	1157.0236.00	1 S		


Ansicht A
View A
Ansicht B
View B
Ansicht B
View B
Ansicht A
View A
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100
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VAR03 161
120
VAR08 130
VAR26 140
VAR08 135
VAR08 136
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10 VAR03/08
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30 VAR03/08
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315 VAR26
295 VAR03/08
330 VAR03/08
350
270 VAR03
280 VAR08
290 VAR26
210
180
170
225
220
190
200
83
Kabel/Cable
VAR03/MOD03 DW 1129.9490.03
DV 1129.9749.03
VAR08/MOD08: DW 1129.9490.08
DV 1129.9749.08
VAR26/MOD26. DW 1129.9490.26
DV 1129 9749.26
Kabel nach Beschriftung montieren.
See connector designation of cables
and motherboard for cable mounting.
VAR03/MOD03 = FSU 3,6GHz
VAR08/MOD08 = FSU 8GHz
VAR26/MOD26 = FSU 26,5GHz
ROHDE&SCHWARZ
SPECTRUM ANALYZER FSU
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26.07.2002
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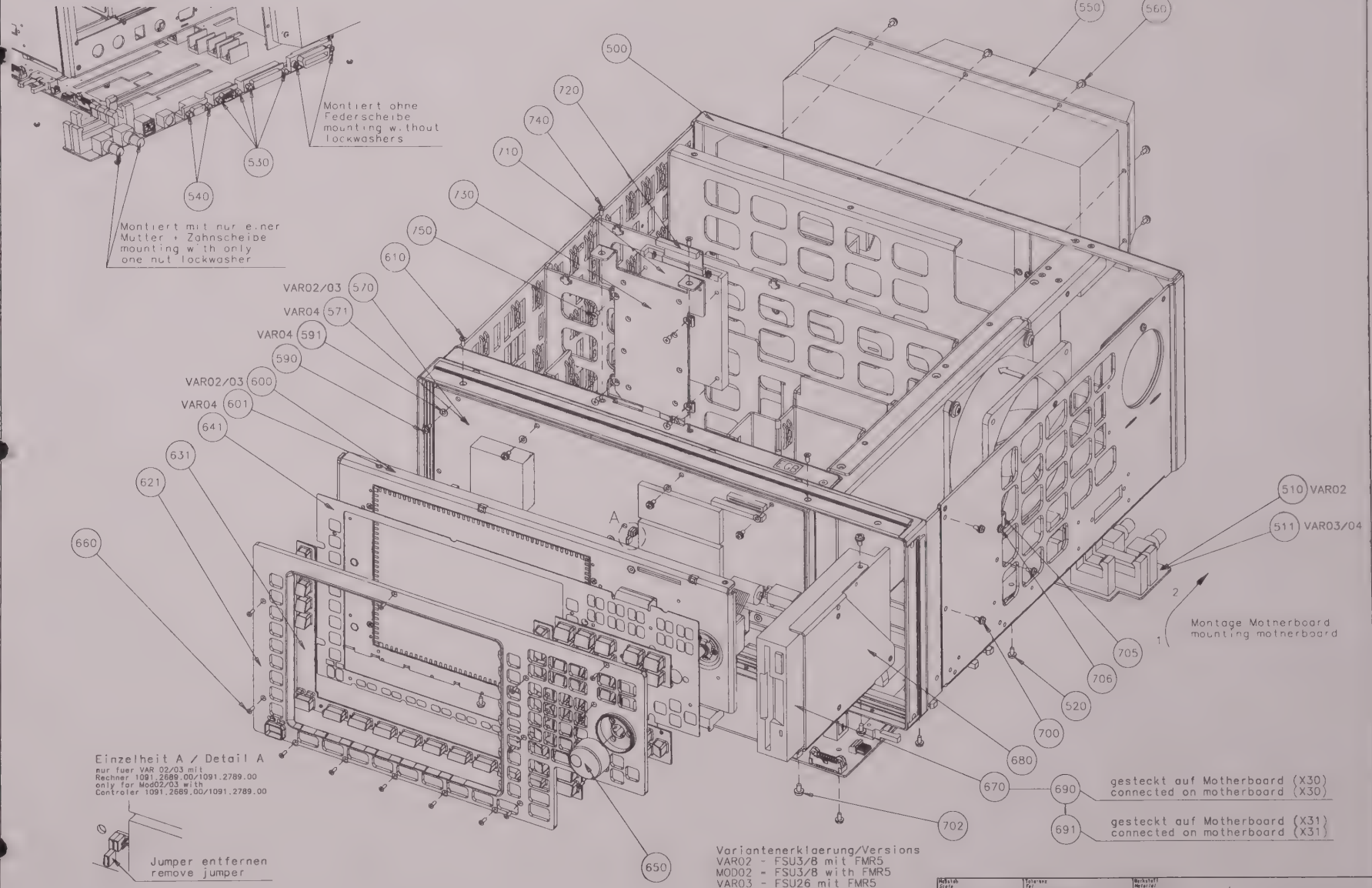

ROHDE&SCHWARZ	GRUNDEINHEIT Basic Unit			de en	03.00	1
Typ FSU						
1129.9003.01	1129.9032.01	D				

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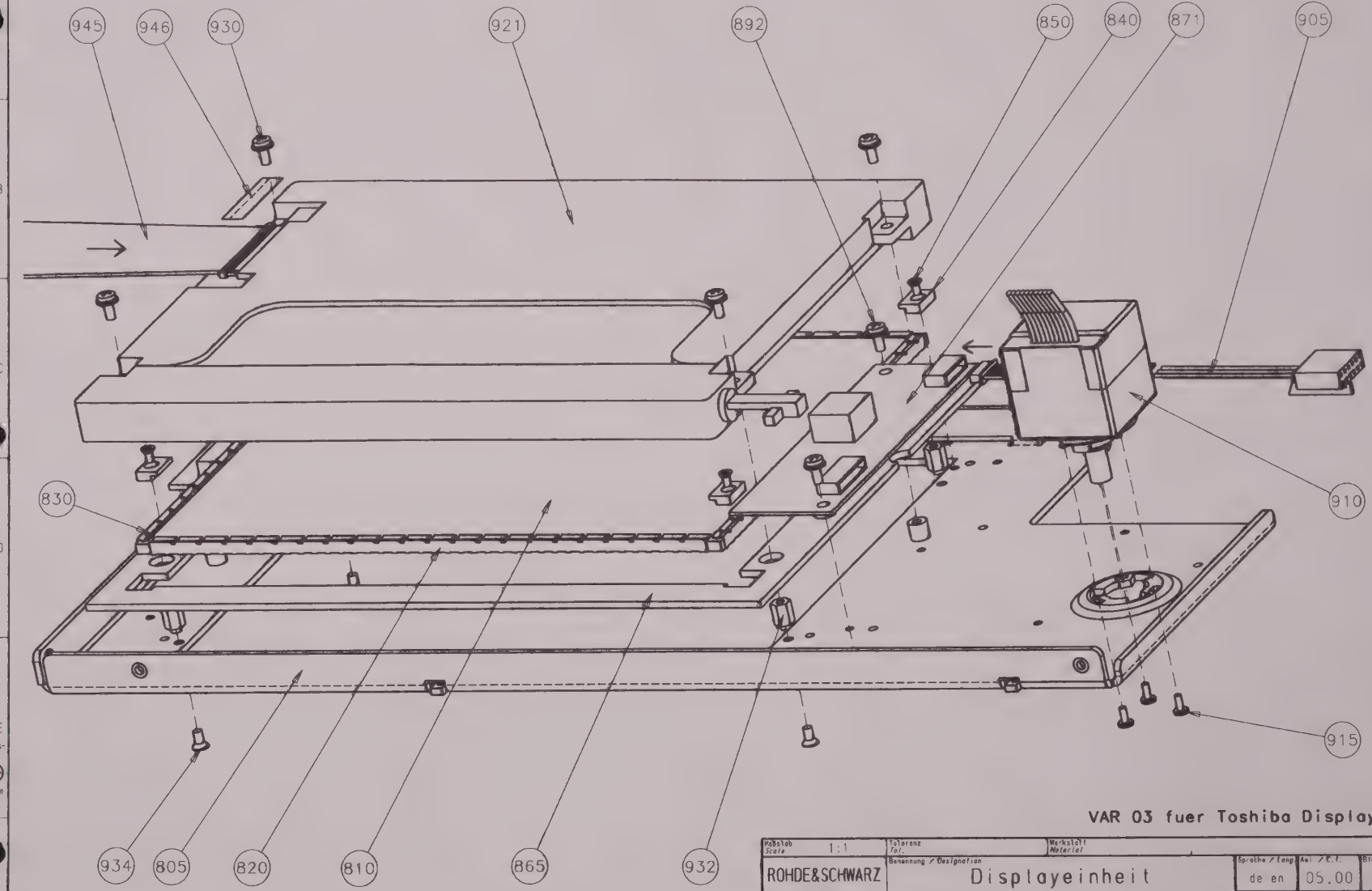

VAR 03 fuer Toshiba Display

Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material			
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Typ / Type: EMU					Zeichn. Nr. / Drawing No.: 1093.4708.01	D
I.Z. / used in: 1129.9090.01	Datum / Date: 01.03.2001	Abteilung / Dept.: 1ESK	Name / Name: Wn			

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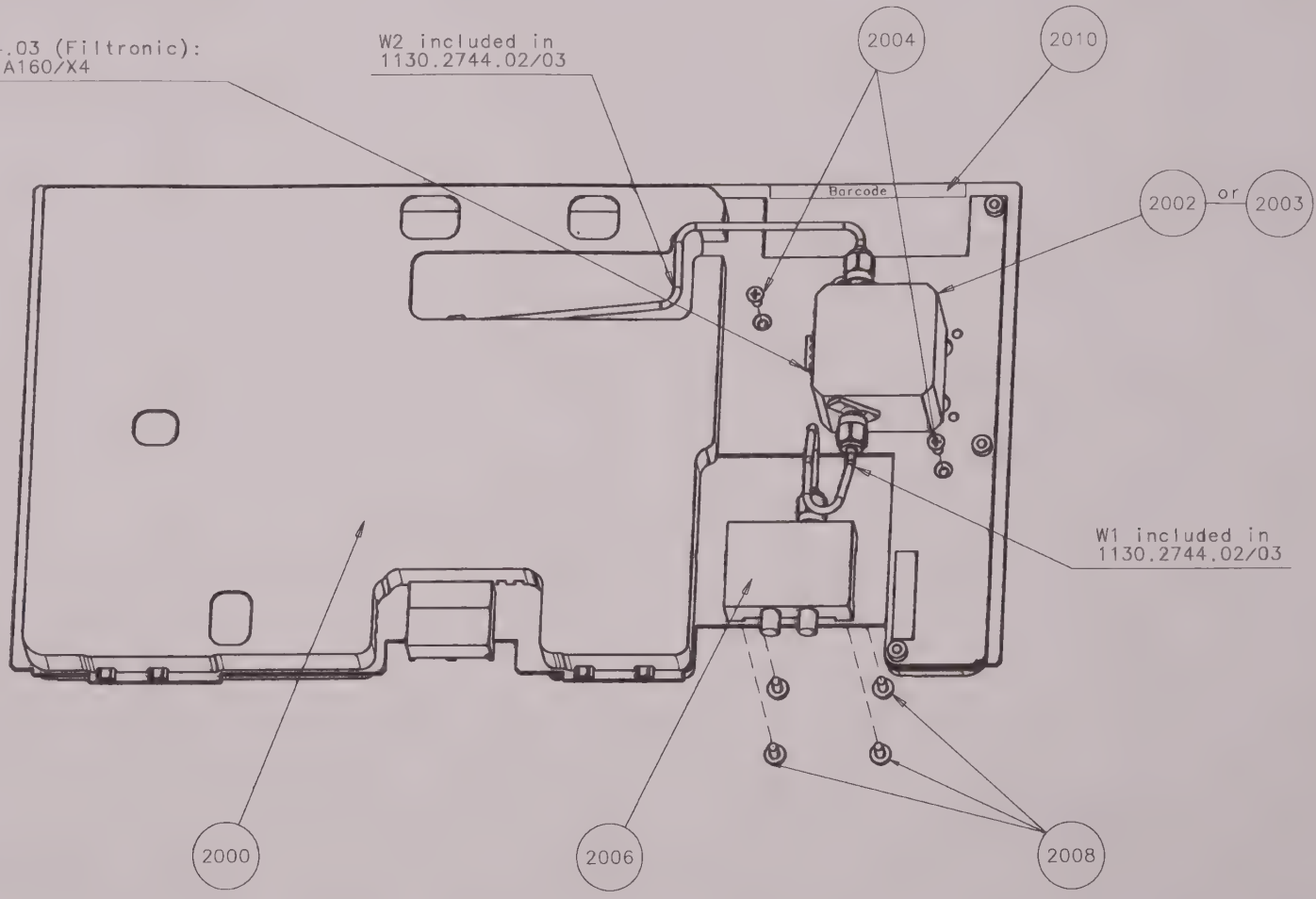
Projektionsmethode
Projection Method



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Projektions-methode
Projection Method

Maßstab Scale	Toleranz Tol.	Werkstoff Material					
ROHDE&SCHWARZ	Benennung / Designation: ZE CONVERTER UNIT (8GHZ)				Sprache / Lang. de en	Änd. / C.F. 02.00	Blatt / Sh. 1
Typ Type					Zeichn.Nr. / Drawing No. 1130.2396.01		D
Z. used in	Datum Date 23.01.2002	Abteilung Dept. 1ESK	Name Name TF				

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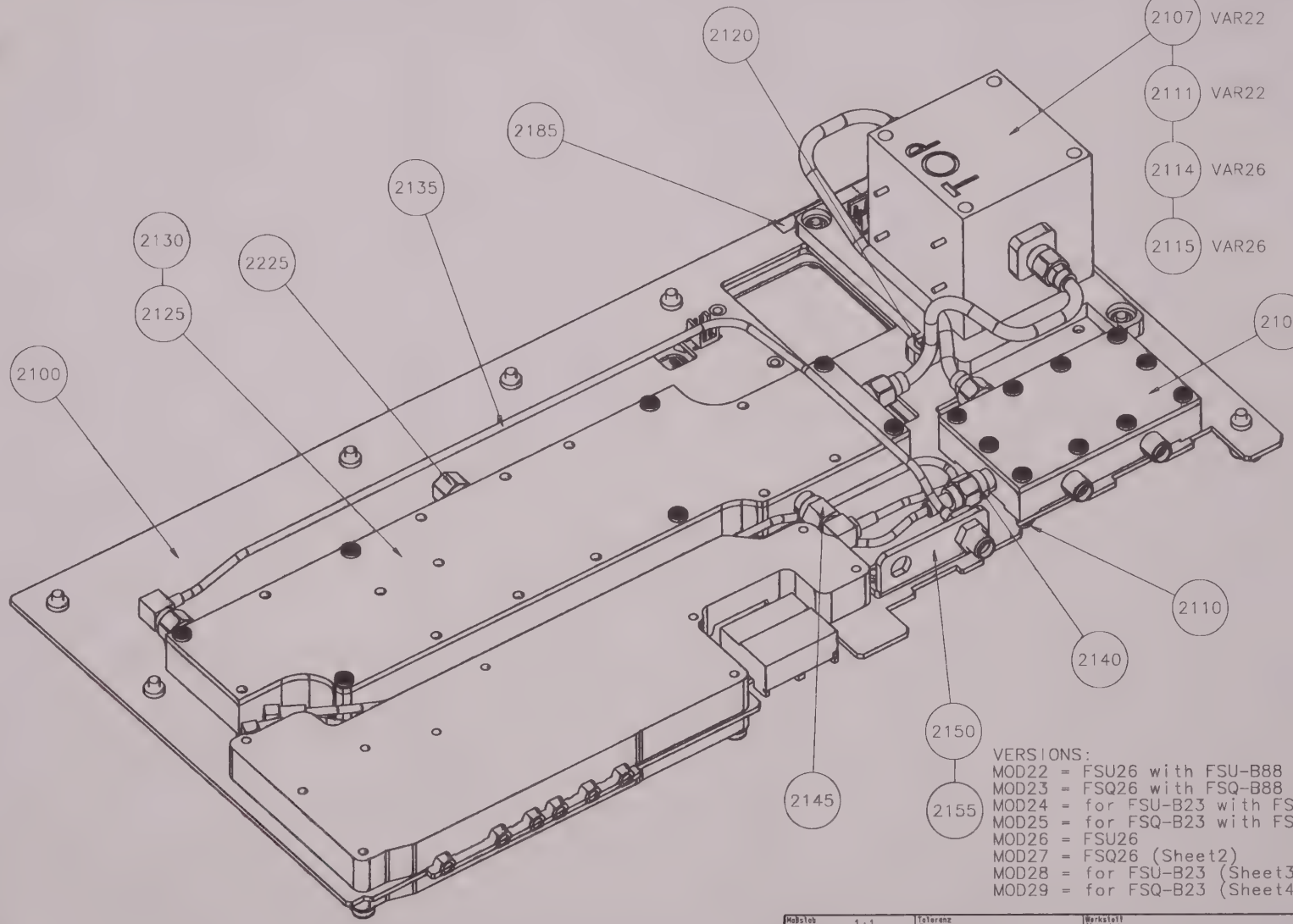
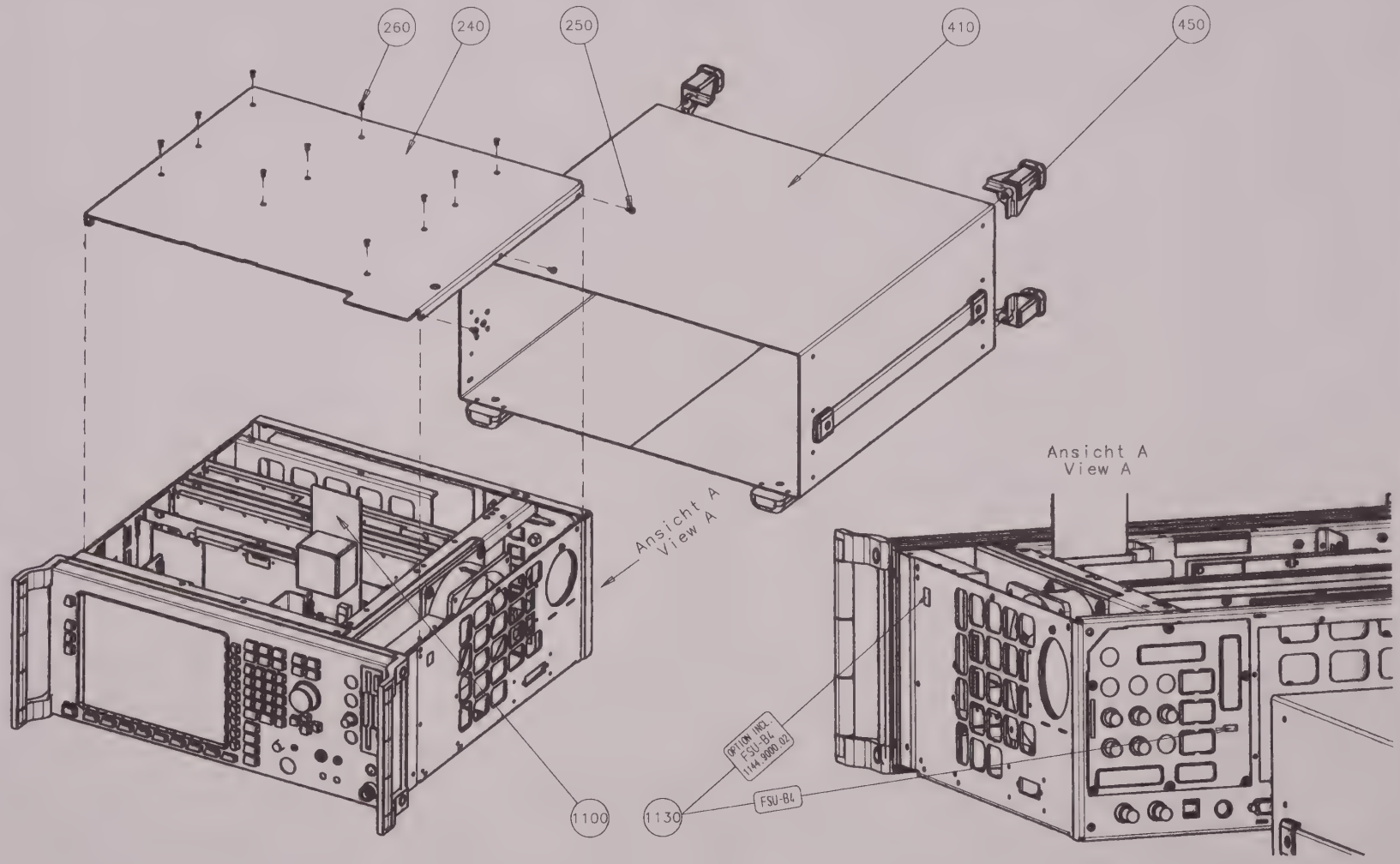


VERSIONS:
MOD22 = FSU26 with FSU-B88
MOD23 = FSQ26 with FSQ-B88 (Sheet2)
MOD24 = for FSU-B23 with FSU-B88 (Sheet3)
MOD25 = for FSQ-B23 with FSQ-B88 (Sheet4)
MOD26 = FSU26
MOD27 = FSQ26 (Sheet2)
MOD28 = for FSU-B23 (Sheet3)
MOD29 = for FSQ-B23 (Sheet4)

Projektions-methode
Projection Method

Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 26			Sprache / Lang.: de en	Änd. / E.T.: 05.00	Blatt / Bl.: 1
Typ / Type: FSU26	MW-Converter Unit 26			Zeichn.Nr. / Drawing No.: 1130.3240.01		D
I.Z. / used in: 1130.9003.01	Datum / Date: 06.10.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn			



Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		Sprache / Lang.	Bl. / Sh. / Blatt / Bl.
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung FSU-B4 / Installation Instruction			de en	02.00 / 1
Typ / Type: FSU-B4				Zeichn.-Nr. / Drawing No.: 1144.9017.00 D	
I.Z. / used in: 1144.9000.01	Datum / Date: 24.11.2000	Abteilung / Dept.: IESK	Name / Name: TF		

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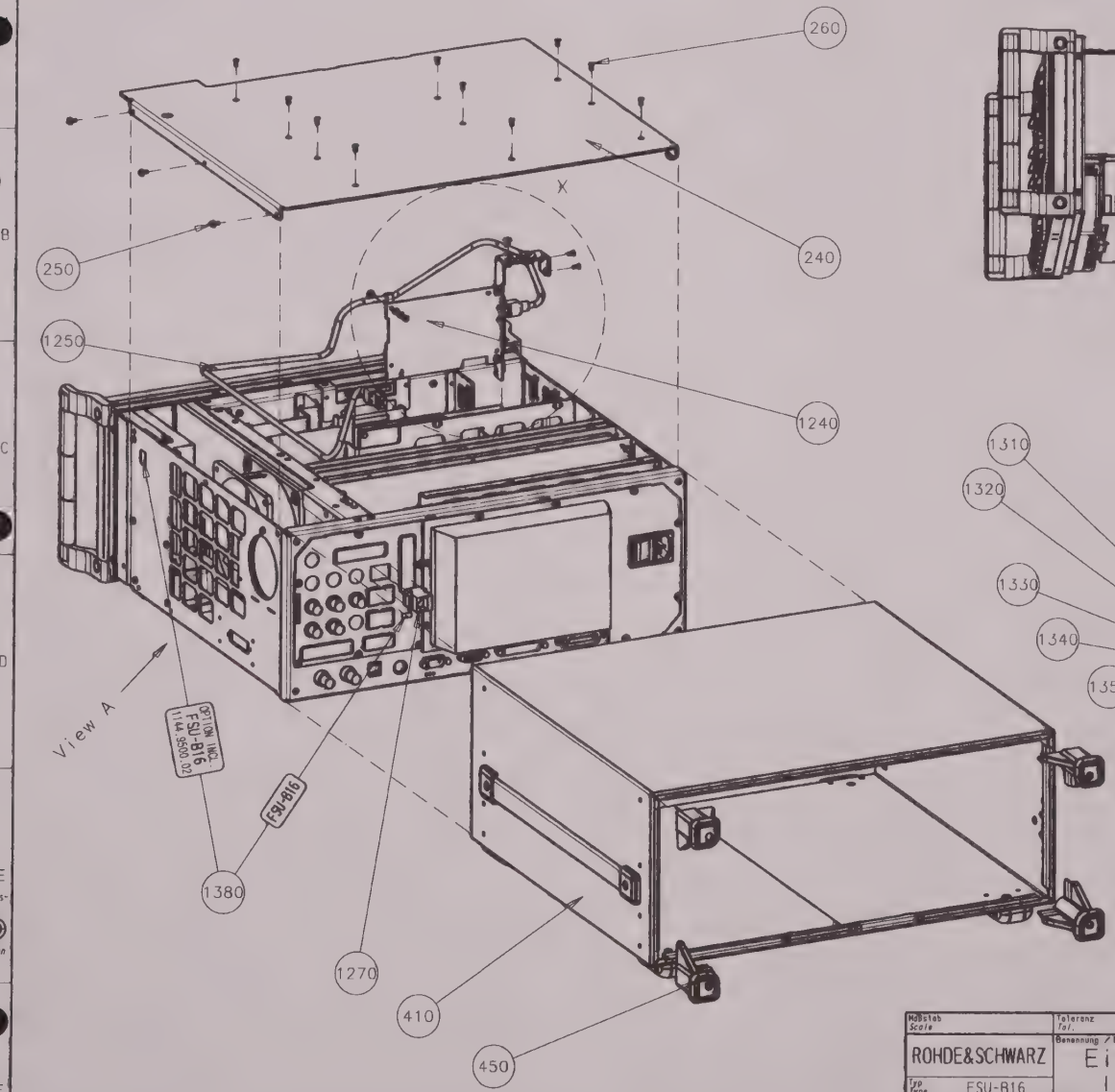

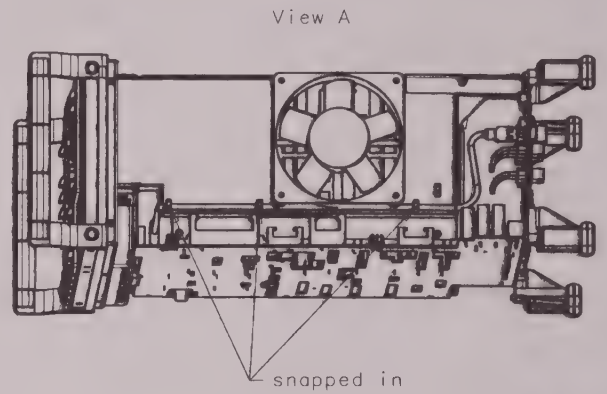

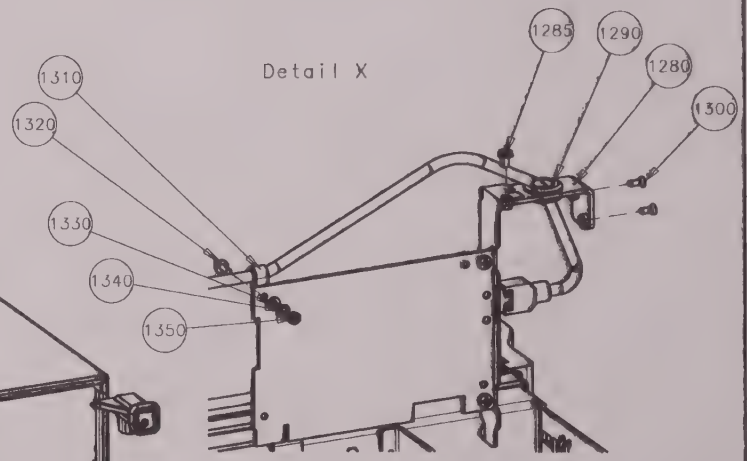

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		Sprache / Lang.	Ausl. / E.C.	Blatt / Sh.
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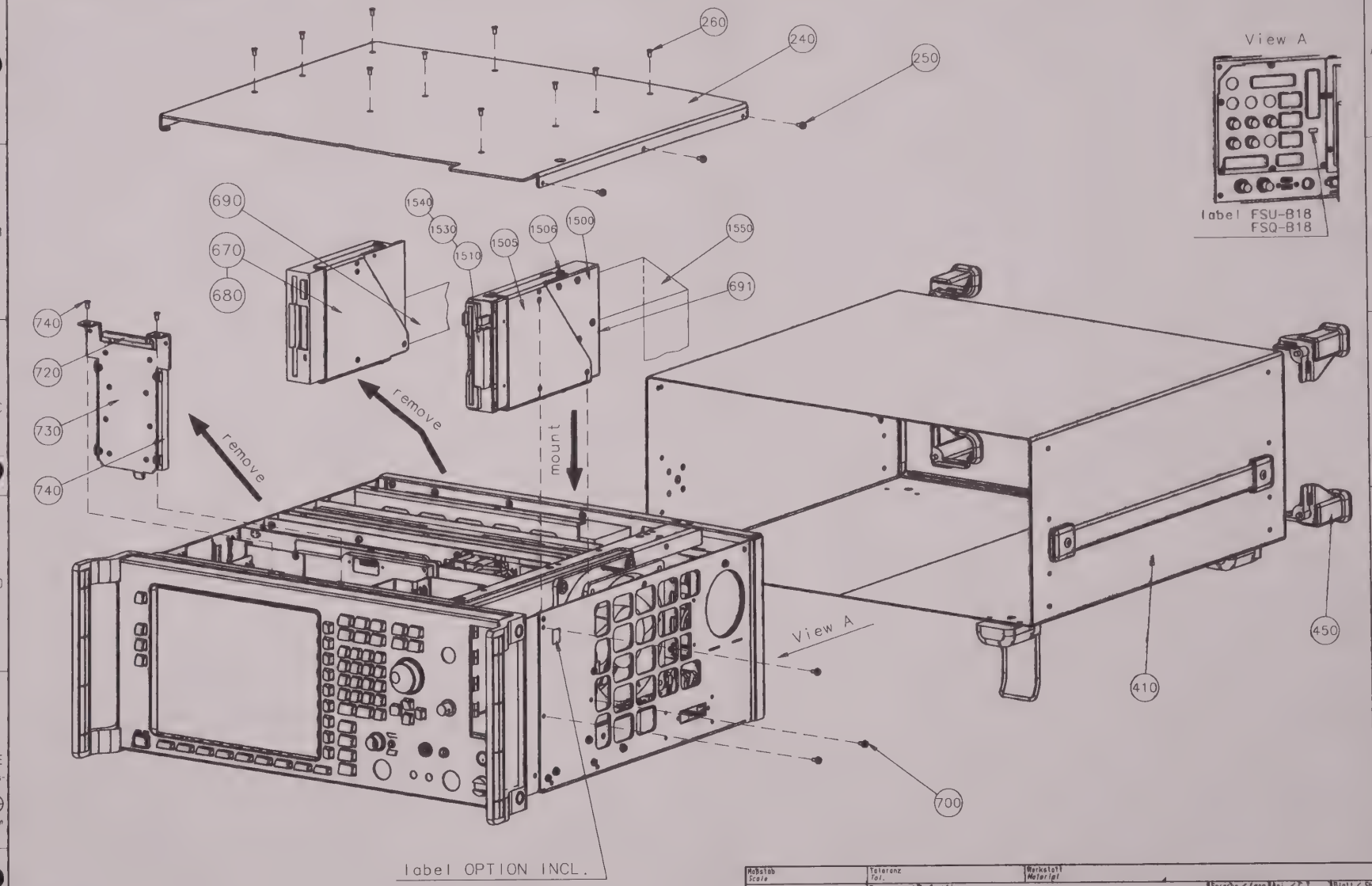
Typ / Type: FSU-B16				Zeichn.-Nr. / Drawing No.: 1144.9500.00		D
T.Z. / used in: 1144.9498.01	Datum / Date: 07.03.2001	Abteilung / Dept.: IESK	Name / Name: Wn			



Maßstab / Scale	Toleranz / Tol.	Werkstatt / Material		Sprache / Lang.	Ausf. / E.V.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation: Assembly Instruction Assembly Instruction			de en	02.00	1
FSU-B18	Datum / Date: 16.10.2003	Abteilung / Dept.: 1EDK	Name / Name: Wn	Zeichn.-Nr. / Drawing No.: 1145.0259.00		D

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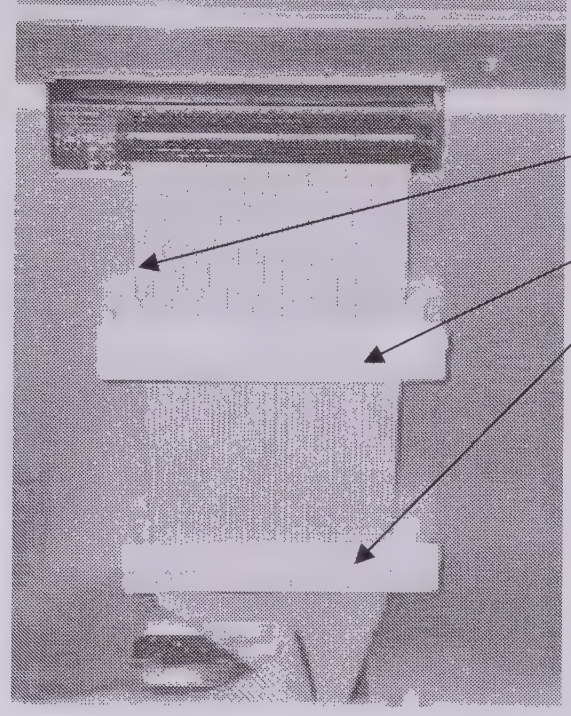
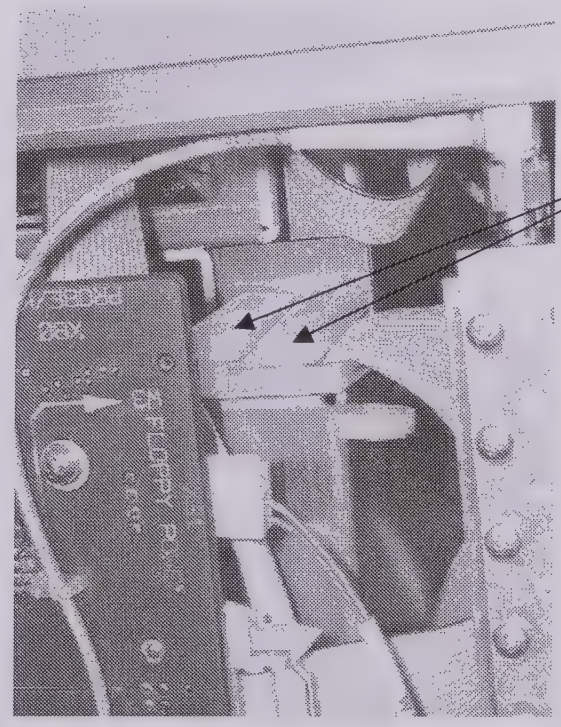
Projektionsmethode
Projection Method





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Maßstab: / Scale:	Toleranz: / Tol.:	Rauht.: /Roughn.:	Kanten: / Edges:	Werkstoff: / Material:	Werknormen: / Company Standards:

ROHDE&SCHWARZ	Benennung: Designation: Assembly Instruction			Sprache: / Lang.: de en	Aei: / C.I.: 01.00	Blatt: / Sh.: 2
Typ: Type: FSU-B18	Datum: Date: 11.02.02	Abteilung: Dept.: 1ESK	Name: Name: TF	Zeichn. Nr.: / Drawing Nr.: 1145.0259.00		D
1. Z.: used in:						

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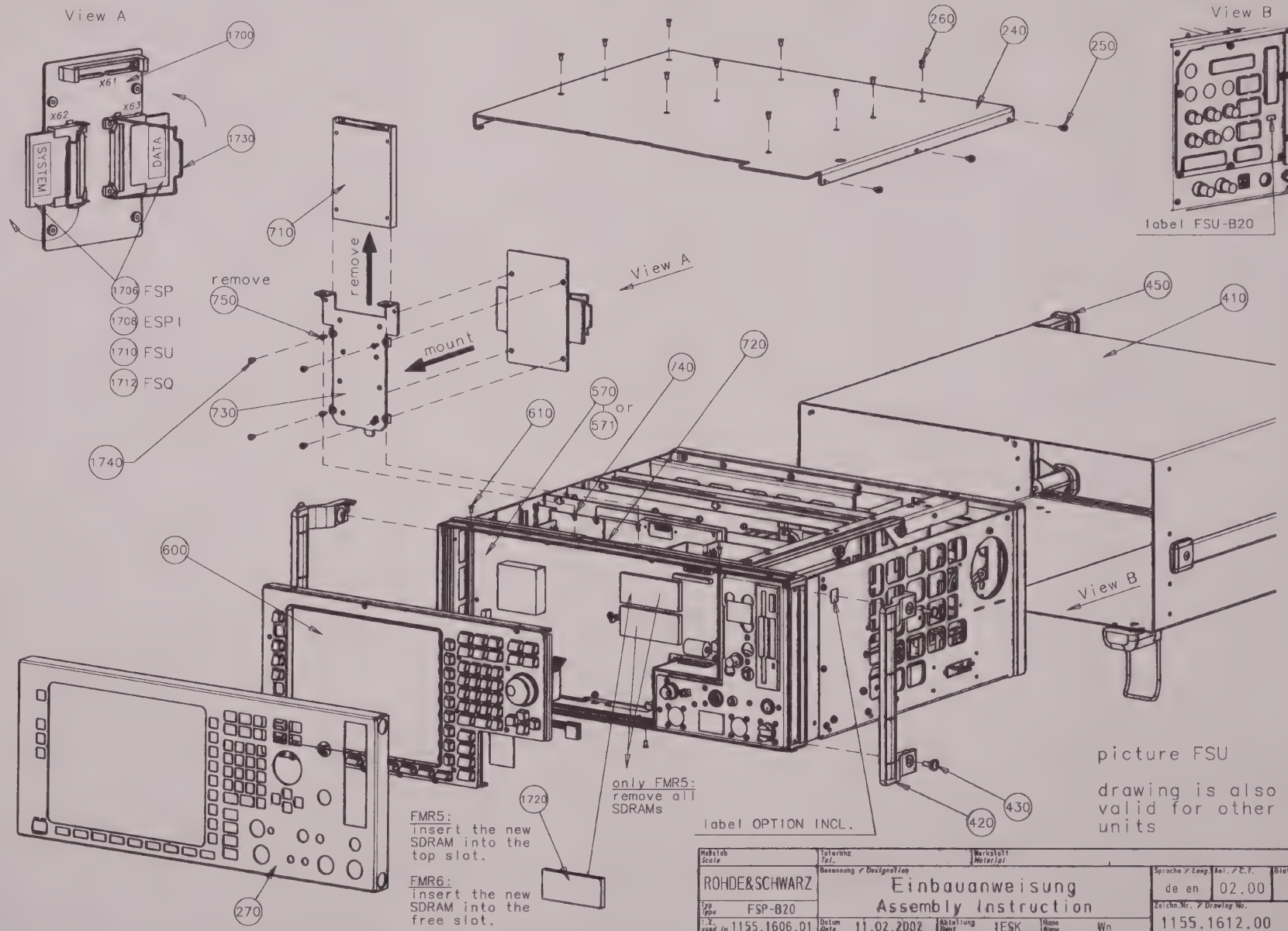
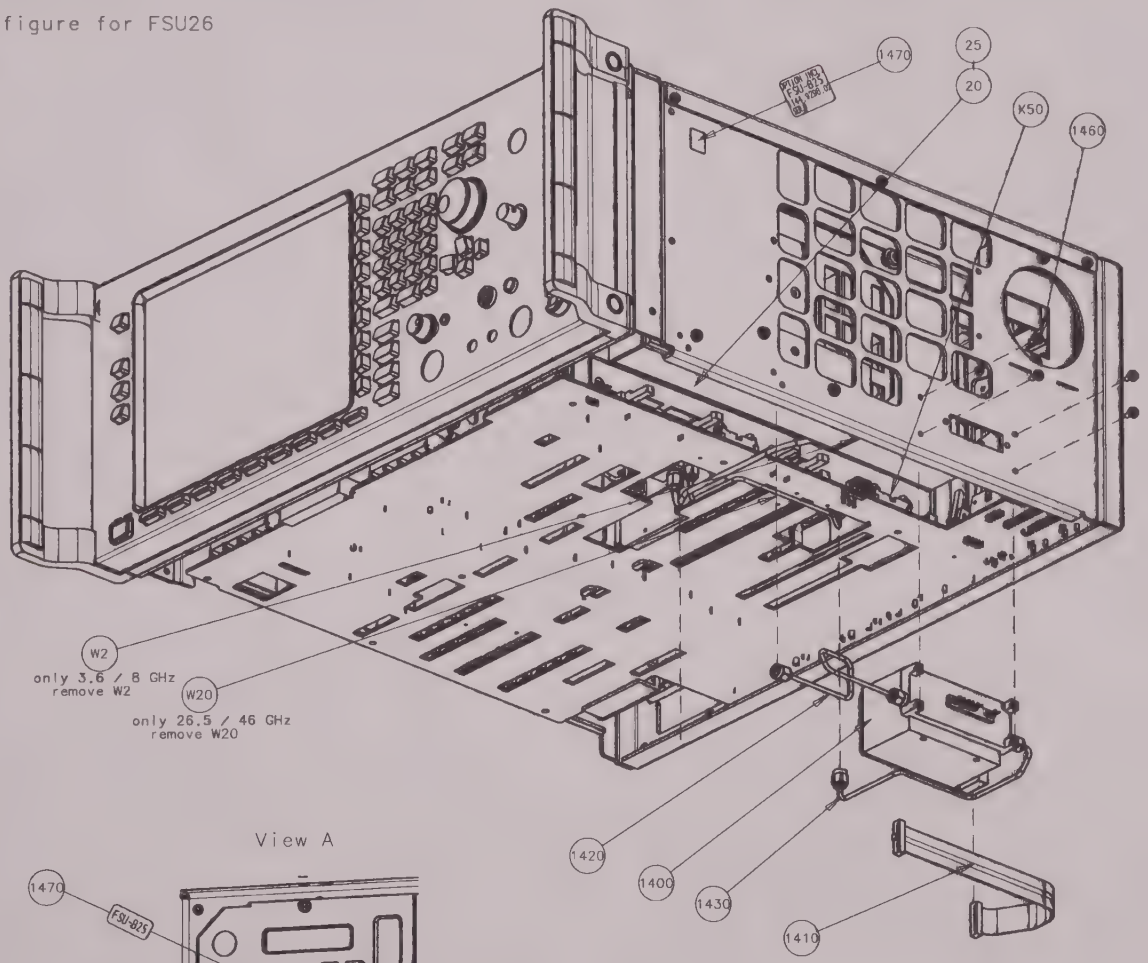


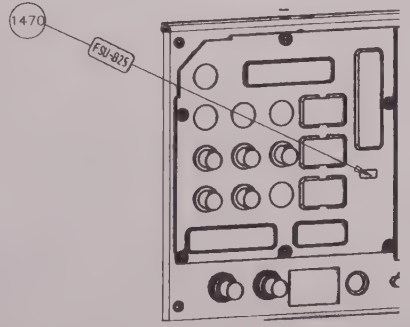
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung / Assembly Instruction			Sprache / Lang.: de en	Änd. / E.C.: 02.00
Typ / Type: FSP-B20				Zeichn.-Nr. / Drawing No.: 1155.1612.00	Blatt / Sh.: 1 D
I.T. used in: 1155.1606.01	Datum / Date: 11.02.2002	Abteilung / Dept.: TESK	Name / Name: Wn		

Projektionsmethode
Projection Method

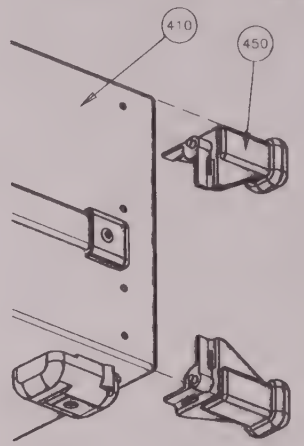
figure for FSU26



View A

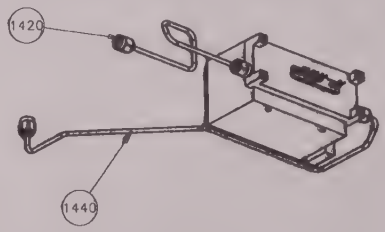


View Attenuator 3,6GHz Units

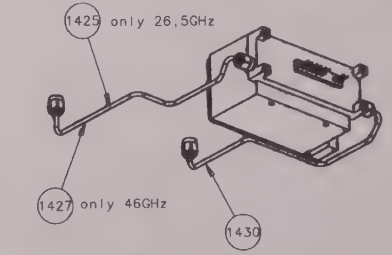


View A

View Attenuator 8GHz Units



View Attenuator 26,5/46GHz Units



Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: INSTALATION INSTRUCTION		Sprache / Lang.: de en	Kel. / C.I.: 03.00	Blatt / Sh.: 1
Typ / Type: FSU-B25				Zeichn.Nr. / Drawing No.: 1144.9300.00	D
T.Z. used in: 1144.9298.01	Datum / Date: 19.02.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn		

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Projektions-methode
Projection Method

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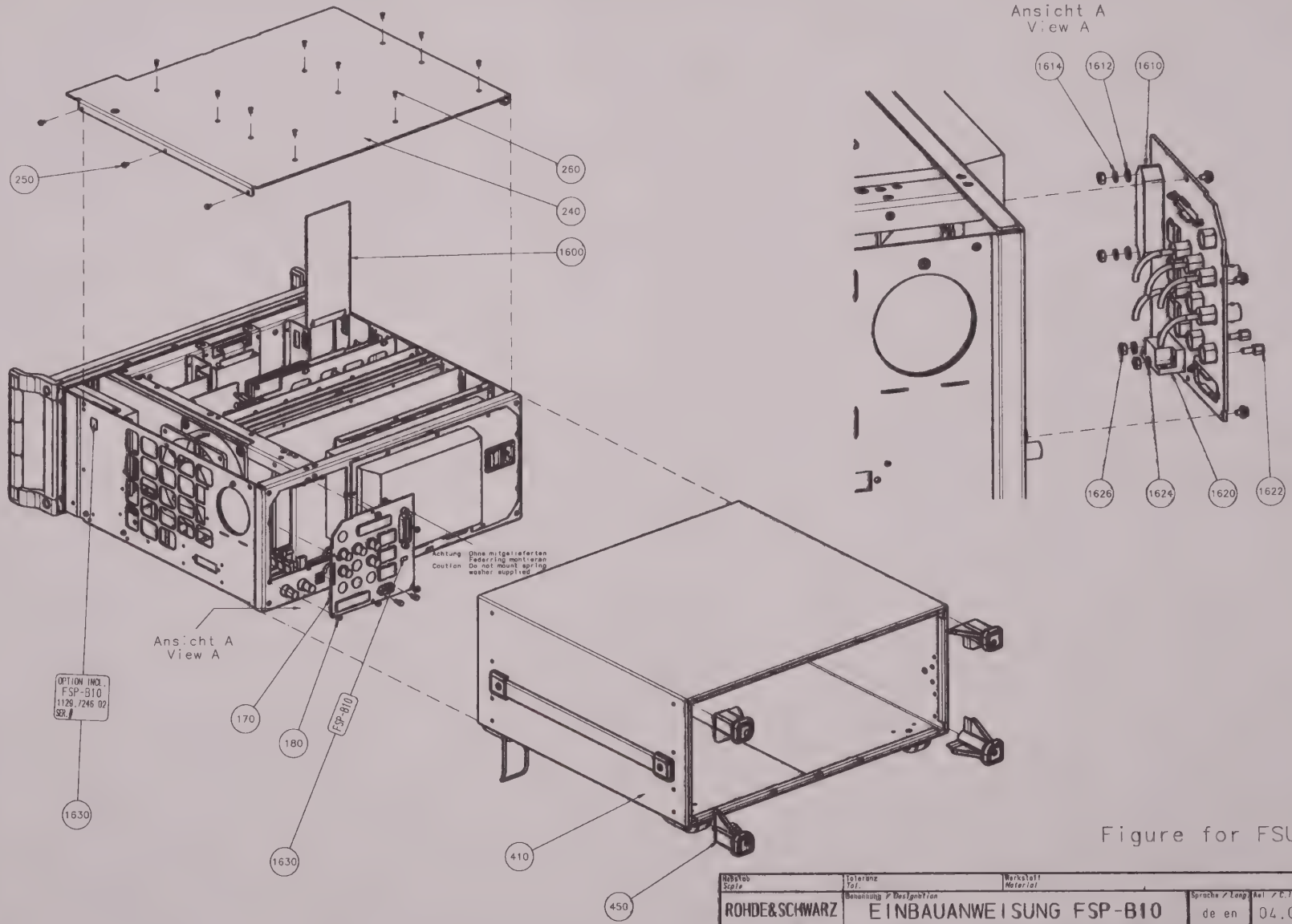
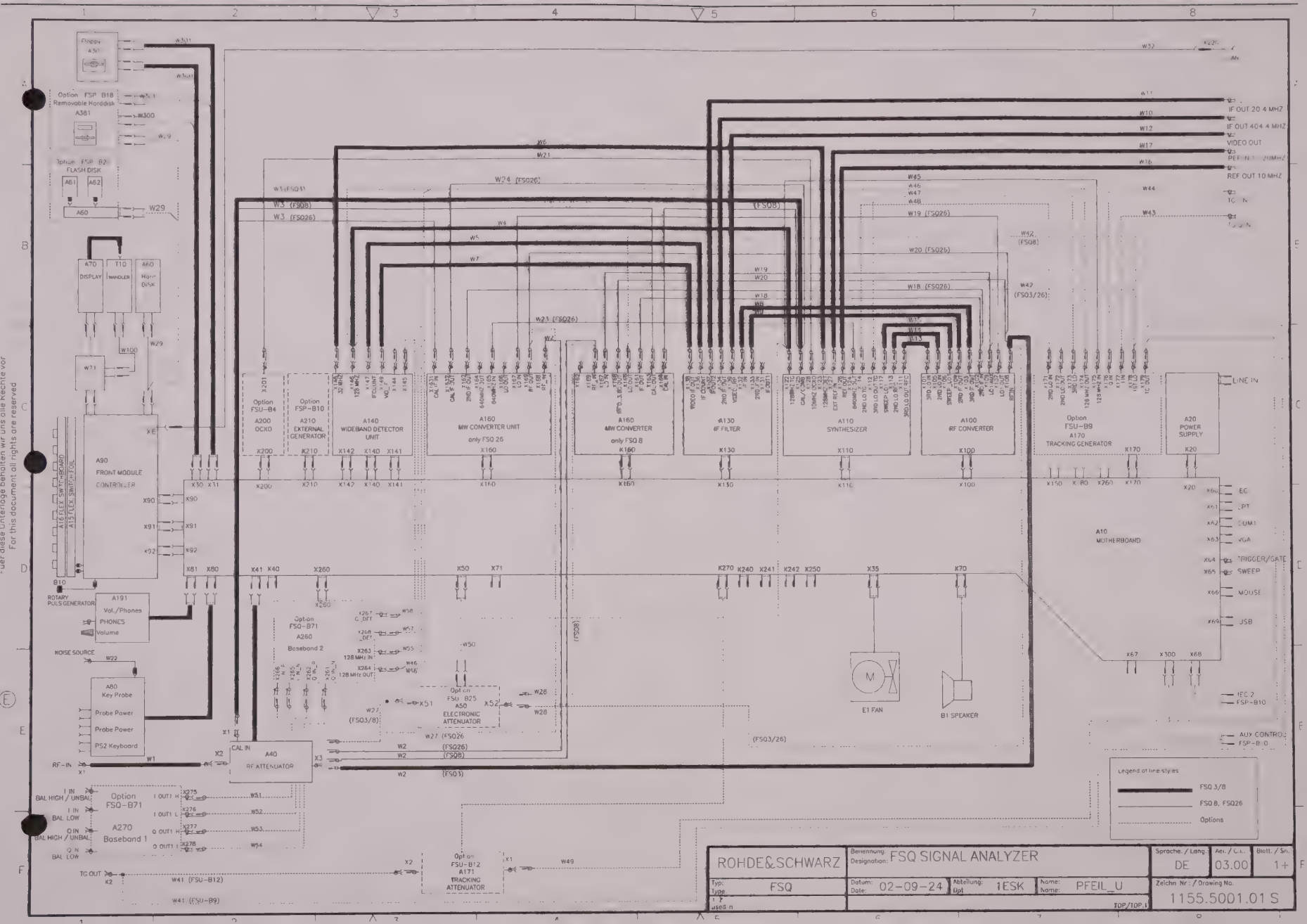


Figure for FSU

Maßstab Scale	Toleranz Tol.	Werkstoff Material			
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSP-B10 INSTALLATION INSTRUCTION			Sprache / Lang. de en	Ausl. / E.C. 04.00	Blatt / Sh. 2
Typ Type FSU				Zeichn.-Nr. / Drawing No. 1129.7298.00		D
I.E. visa in 1129.7246.01	Datum Date 29.10.2001	Abteilung Dept. 1ESK	Name Name Wn			

ROHDE&SCHWARZ

Block Circuit Diagram



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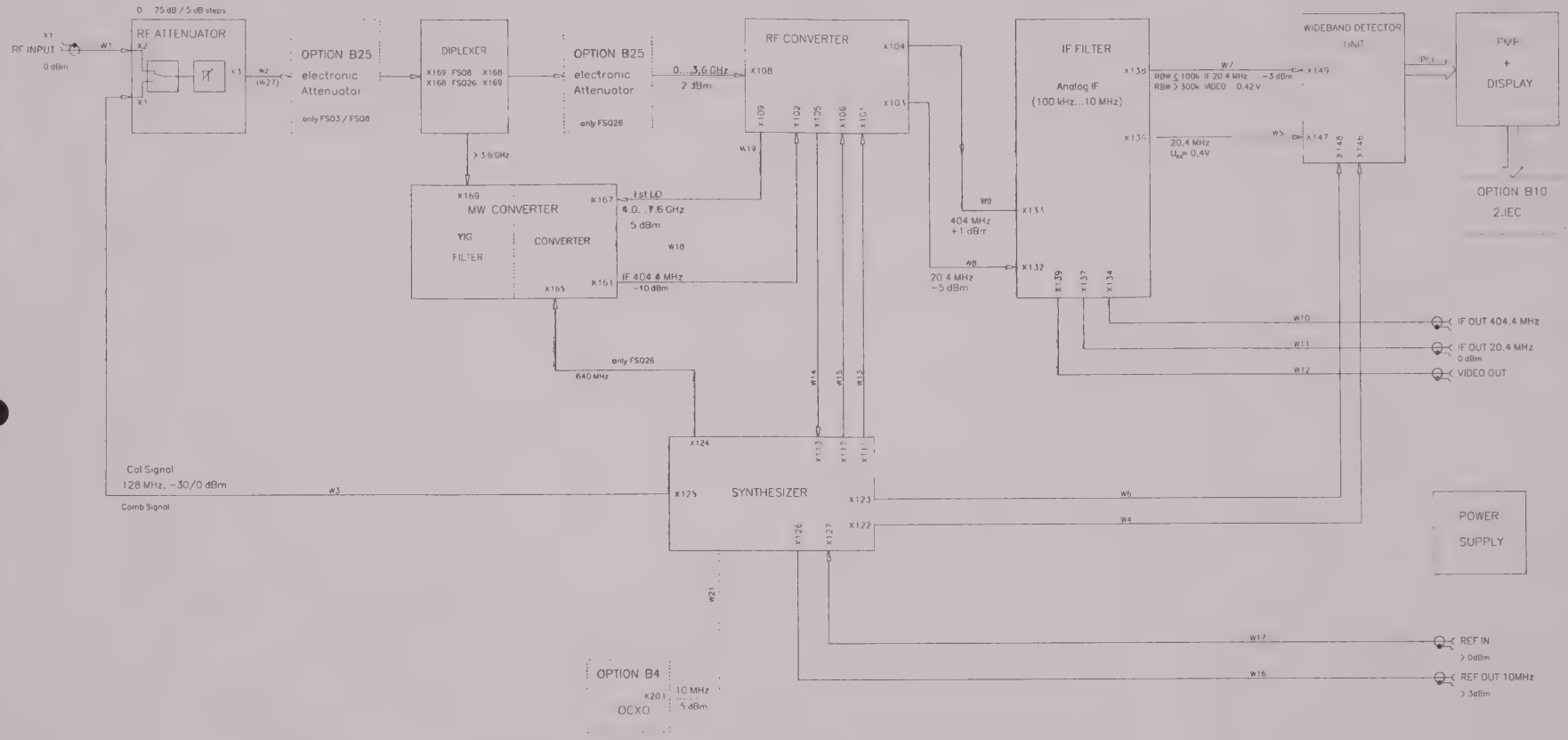

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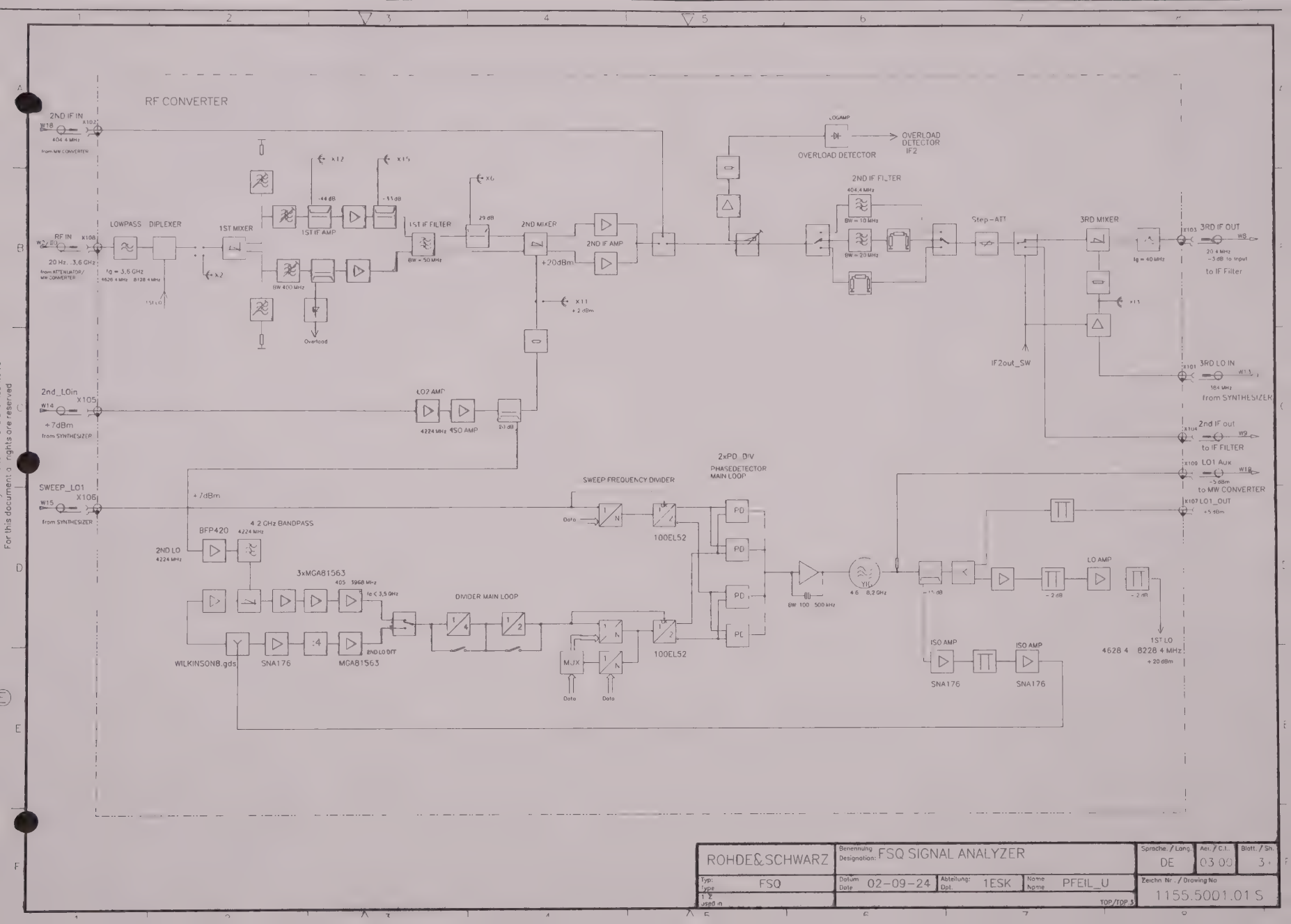
Typ / Type: FSQ	Datum / Date: 02-09-24	Abteilung / Dpt: 1ESK	Name: PFEIL_U	Zeichn Nr. / Drawing No: 1155.5001.01 S		
1 2 used in	TOP/TOP 2					



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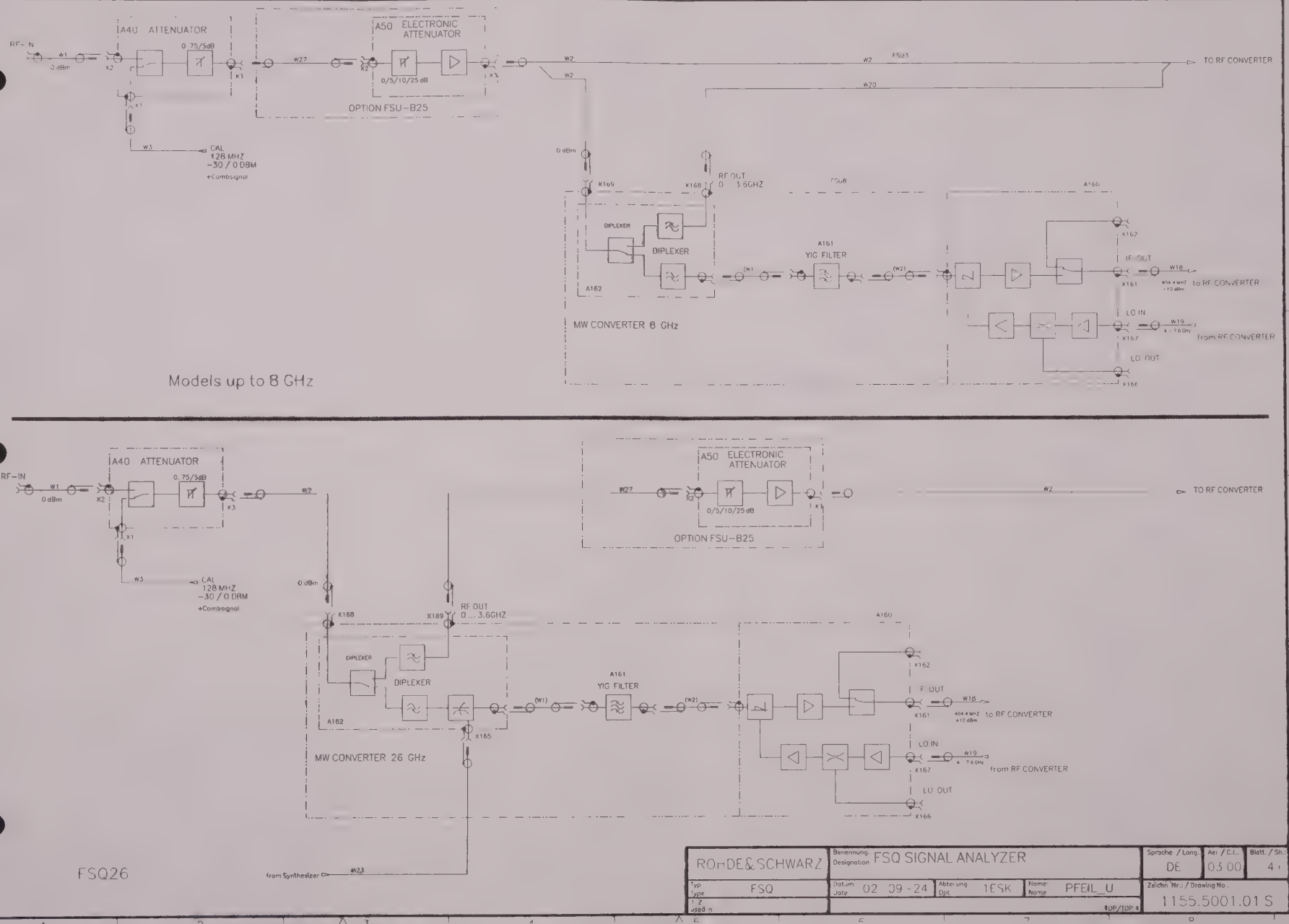
Typ: FSQ	Datum / Date: 02-09-24	Abteilung: Dpt.: 1ESK	Name: PFEIL_U		Zeichn. Nr. / Drawing No: 1155.5001.01 S		
used in	TOP/TOP.3						



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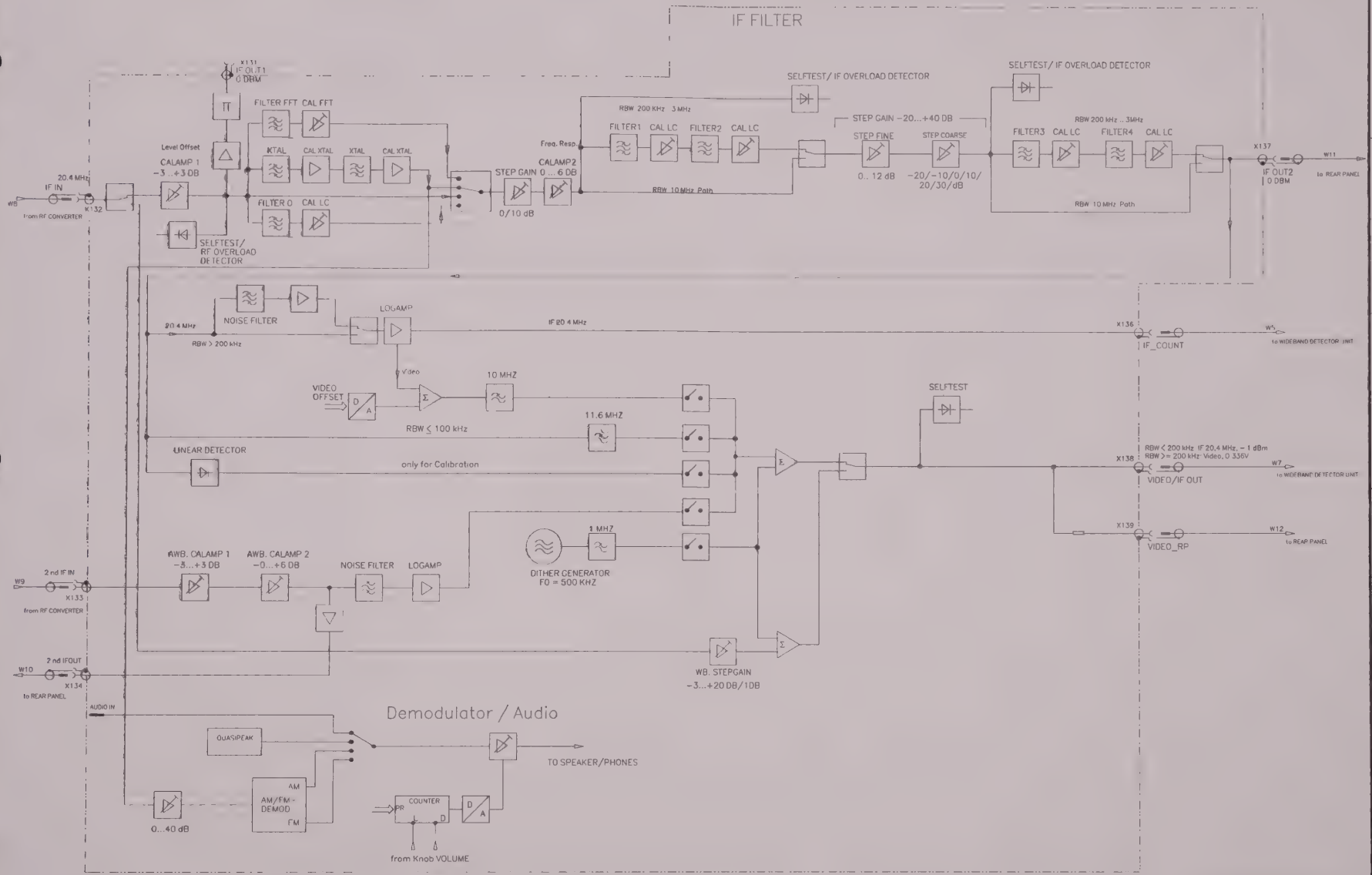
I.Z. / Ident n.			TOP/TOP 4			



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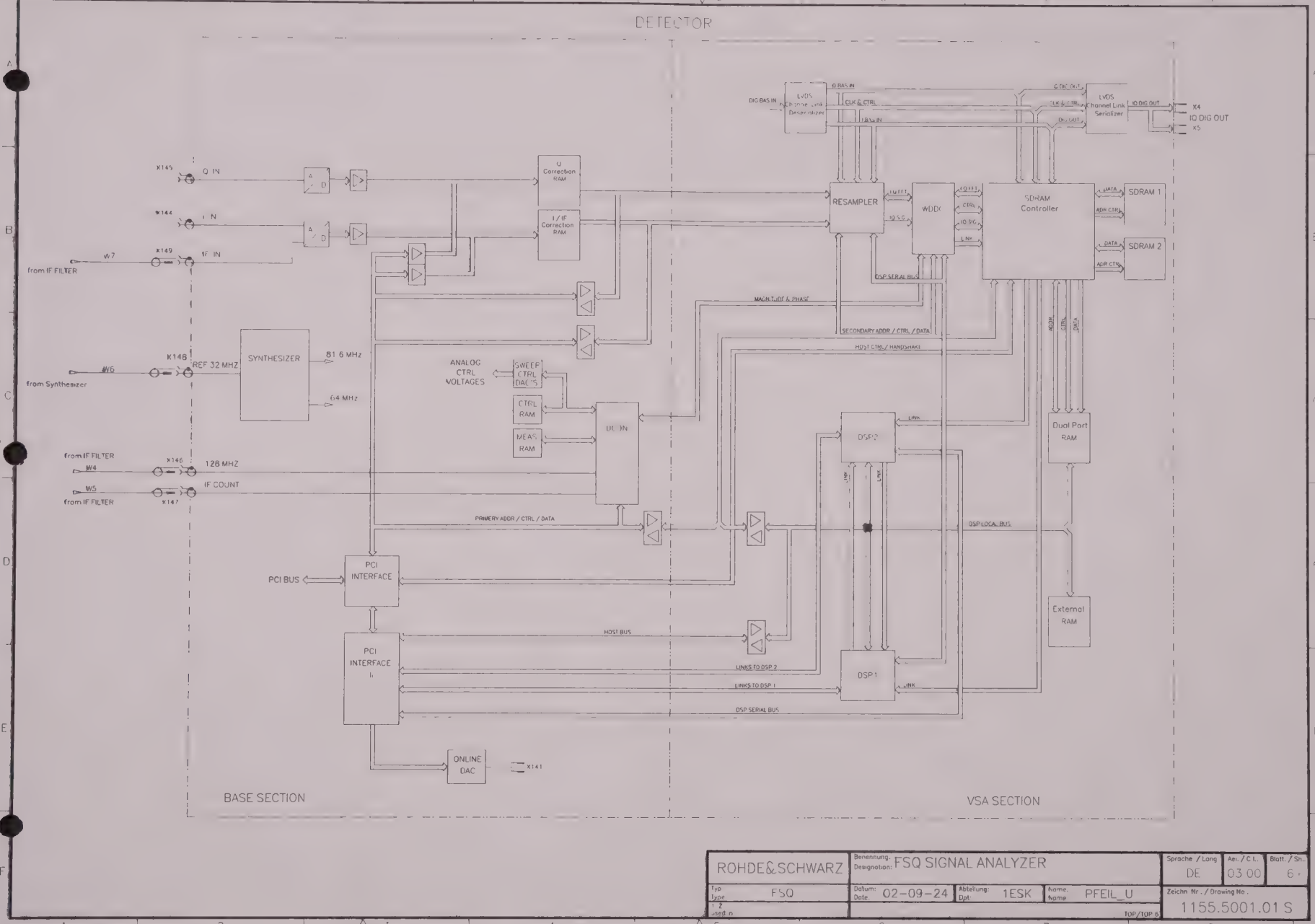
Typ: Type: FSQ	Datum: Date: 02-09-24	Abteilung: Dpt. 1ESK	Name: Name: PFEIL_U	TOP/TOP 5	Zeichn. Nr. / Drawing No. 1155.5001.01 S		



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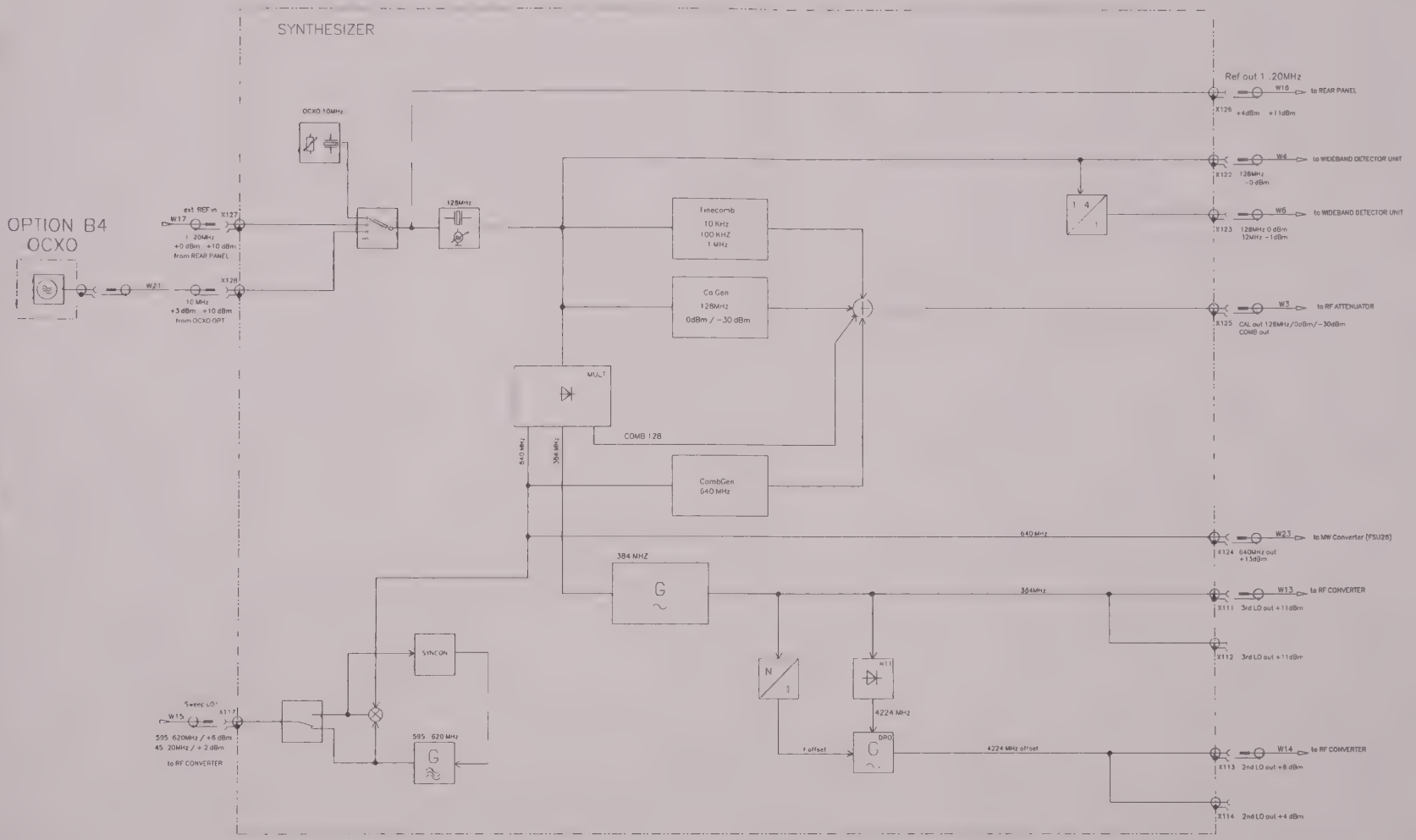
Typ Type: FSQ	Datum: Date: 02-09-24	Abteilung: Dpt: 1ESK	Name: Name: PFEIL_U	TOP/TOP 6	Zeichn. Nr. / Drawing No.: 1155.5001.01 S		



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1 Z used in	TOP/TOP 7					

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